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Geotechnical and Structures Laboratory

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Airfield Pavement Evaluation, Butts Army Airfield, Fort Carson, Colorado

Robert W. Grau, Patrick S. McCaffrey, Jr., and Dan D. Mathews

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Final report

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ABSTRACT: An airfield pavement evaluation was performed in May 2002 at Butts Army Airfield, Fort Carson, Colorado, to develop information pertaining to the structural adequacy of the airfield pavements for continued use under its current mission and the upgrading of the pavements for mission changes. The pavement surface condition was evaluated using the Pavement Condition Index (PCI) survey procedure, and a nondestructive evaluation procedure was used to determine the load-carrying capability of the pavements and overlay requirements for continued use of the pavements under current missions. Results of the evaluation are presented including: (a) a tabulation of the existing pavement features, (b) the results of the nondestructive tests performed using a heavy weight deflectometer, (c) the PCI and rating of the surface of each pavement feature, (d) a structural evaluation and overlay requirements for 6,000 passes of the C-130 aircraft on the fixed-wing pavements and 50,000 passes of the CH-47 aircraft on the rotary-wing pavements, (e) the pavement classification number for each pavement facility, and (f) maintenance and repair recommendations based on the structural evaluation and condition survey.

Contents

Preface

The purpose of this report is to provide an assessment of load-carrying capacity and condition of airfield pavements at Butts Army Airfield (BAAF), Fort Carson, Colorado. This report provides data for the following:

a. Planning and programming pavement maintenance, repairs, and structural improvements.

b. Designing maintenance, repair, and construction projects.

c. Determining airfield operational capabilities.

d. Providing information for aviation flight publications and mission planning.

Users of information from this report include the installation's Directorate of Installation Support (DIS), engineering design agencies (DIS's, U.S. Army Corps of Engineers), Airfield Commanders, U.S. Army Aeronautical Services Agency, and agencies assigned operations planning responsibilities. Information concerning aircraft inventory, passes, and operations shall not be released outside U.S. Government agencies. This report satisfies requirements for condition inspection and structural evaluation established in Army Regulation AR 420-72 (Headquarters, Department of the Army 2000) and supports airfield survey requirements identified in Army Regulation AR 95-2 (Headquarters, Department of the Army 1990).

The Army Airfield Pavement Evaluation Program is sponsored and technically monitored by the U.S. Army Corps of Engineers, Transportation Systems Center (CENWO-ED-TX), located in Omaha, NE. The U.S. Army Forces Command, Fort McPherson, Georgia, provided funding for this investigation.

Personnel of the U.S. Army Engineer Research and Development Center (ERDC), Geotechnical and Structures Laboratory (GSL), Vicksburg, MS, prepared this publication. The findings and recommendations presented in this report are based upon pavement structural testing, data analysis, and condition survey work at BAAF. The required field testing was conducted in May 2002. The evaluation team consisted of Messrs. Dan D. Mathews and Andrew Harrison, Airfield and Pavements Branch (APB), GSL. Messrs. Robert W. Grau, Patrick S. McCaffrey, Jr., and Mathews prepared this publication under the

Mr. Don R. Alexander, Chief, APB; Dr. Albert J. Bush III, Chief, Engineering Systems and Materials Division; and Dr. David W. Pittman, Acting Director, GSL.

At the time of publication of this report, COL John W. Morris III, EN, was Commander and Executive Director of ERDC, and Dr. James R. Houston was Director.

Recommended changes for improving this publication in content and/or format should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded to Headquarters, U.S. Army Corps of Engineers, ATTN: CECW-EW, 441 G Street NW, Washington, DC 20314.

Executive Summary

Personnel of the U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS, conducted the field testing at Butts Army Airfield (BAAF), Fort Carson, Colorado, during May 2002. The structural capacity and physical properties of the pavement facilities were determined from nondestructive tests using a heavy weight deflectometer (HWD) and from measurements taken in previous studies. A visual inspection was also conducted to establish the condition of the airfield surface, which does not necessarily correspond to its load-carrying capacity.

The results of the tests and visual inspection reveal the following:

a. The primary airfield pavement facilities and their assigned Pavement Classification Number (PCN) are shown in Illustration 1.

b. The seven runway features (R1A through R7A), three taxiway features (T2A, T3A, and T6A), and six apron features (A1B, A2B, A3B, A4B, A5B, and A6B) that were considered fixed-wing facilities are structurally inadequate to withstand the projected fixed-wing day-to-day mission (i.e., peacetime use) C-130 traffic. Five of the ten pavement features (T1A, T4B, T5A, A11B, and A12B) that were evaluated for rotary-wing traffic are structurally inadequate to withstand the projected CH-47 traffic.

c. Although the runway overrun (R1A) and Hoverlane (A3B) were reconstructed in 2001, they are structurally inadequate to withstand the projected traffic.

d. Installation Status Report (ISR) ratings for the airfield are shown in Illustration 2.

e. As a result of the very low surface condition ratings of 10 of 11 features failing to meet the minimum Pavement Condition Index (PCI) requirements, repair is recommended for only one feature (T3B). Approximately $33,500 (FY03) for repair is required to improve the surface of taxiway feature T3B to meet the minimum PCI requirements. M & R is not recommended for features R2A through R6A, T1A, T4B through T6A, and A2B.

f. Although the PCI of 10 features (A4B through A13B) meet the minimum PCI requirements, approximately $400,000 (FY 03) in M & R is recommended.

g. In planning structural improvements and/or reconstruction requirements, it should be recognized that UFC 3-260-02 (Headquarters, Departments of the Army, Navy, and the Air Force 2001b) specifies that the following pavements be rigid pavement: all paved areas on which aircraft or helicopters are regularly parked, maintained, serviced, or preflight checked, on hangar floors and access aprons; on runway ends (305 m (1,000 ft) of a Class B runway; primary taxiways for Class B runways; hazardous cargo, power check, compass calibration, warmup, alert, arm/disarm, holding, and washrack pads; and any other area where it can be documented that a flexible pavement will be damaged by jet blast or by spillage of fuel or hydraulic fluid.

h. Overloading the pavement facilities may shorten the life expectancy.

Additional details on structural capacity, surface condition, and work required to maintain and strengthen the airfield are contained in Chapters 2 and 3 of this report.

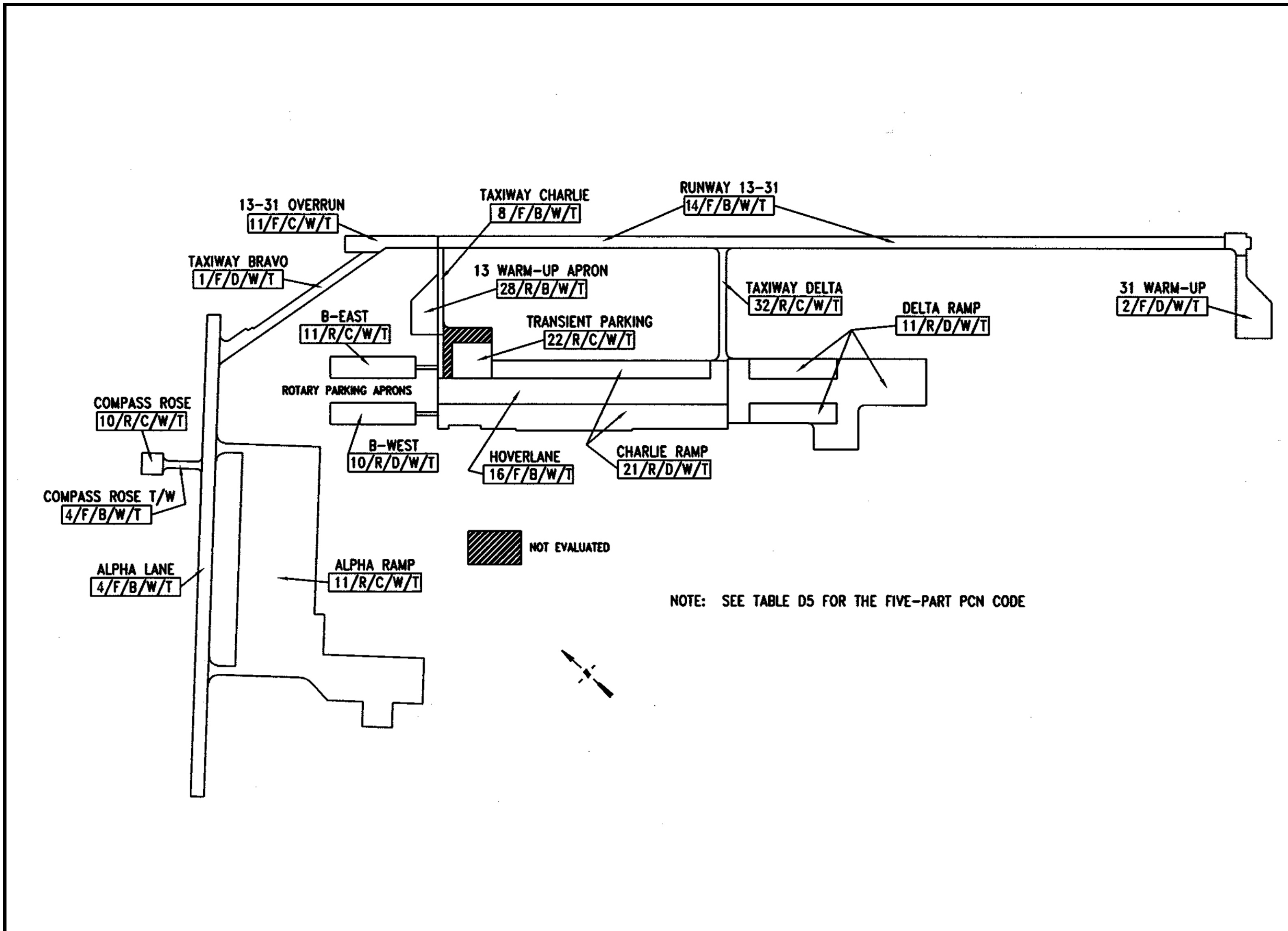

Illustration 1. Airfield Pavement Evaluation Chart (APEC)

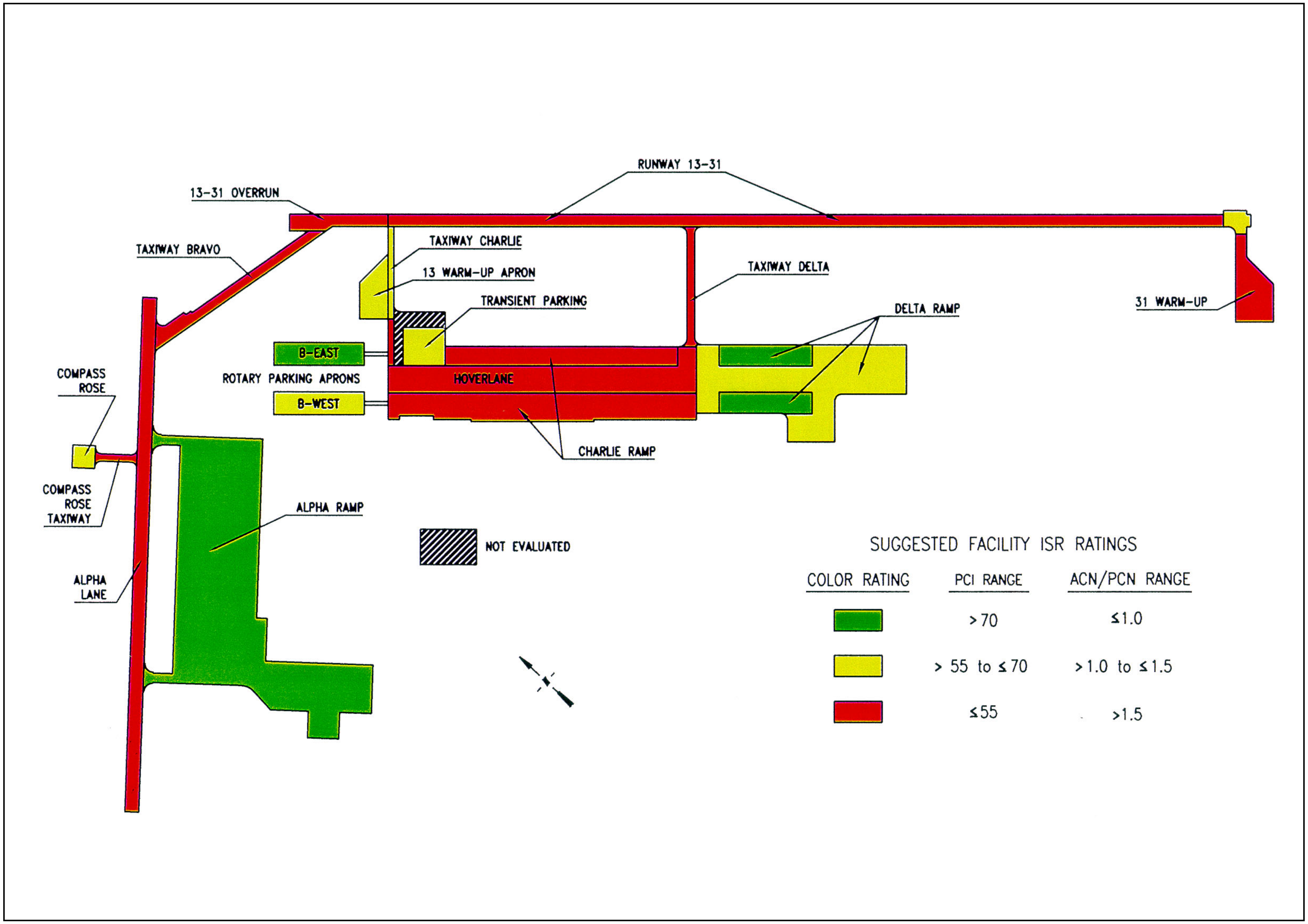

Illustration 2. Airfield pavement ISR ratings

1 Introduction

Background

In May 1982 the Department of the Army initiated a program to determine and evaluate the physical properties, the load-carrying capacity for various aircraft, and the general condition of the pavements at major U.S. Army Airfields (AAFs). This program was established at the request of the Major Army Commands (FORSCOM, TRADOC, and AMC). Headquarters, U.S. Army Corps of Engineers (CECW-EW) sponsors a program for periodic evaluation of Army Airfield facilities in accordance with Army Regulation AR 420-72 (Headquarters, Department of the Army 2000). All Category 1 AAFs and instrumented U.S. Army Heliports (AHPs) are included in the CECW-EW program. The evaluation of the airfield pavements was performed to determine the structural adequacy of the existing pavements to accommodate mission aircraft. Results of this evaluation were also used to identify maintenance, repair, and major repair work requirements and to help establish Installation Status Report (ISR) ratings. The U.S. Army Forces Command, Fort McPherson, Georgia, provided funding for this investigation. Results of this investigation will provide current information for designing upgrades to the pavement facilities.

Objective and Scope

The primary objectives of this investigation were to determine the allowable aircraft loads and design traffic, and to identify maintenance, repair, and structural improvement needs for each airfield pavement feature. These objectives were accomplished by:

a. Obtaining records of day-to-day traffic operations from the installation Airfield Commander.

b. Conducting a structural evaluation of the airfield pavements in accordance with UFC 3-260-03 (Headquarters, Departments of the Army, Navy, and the Air Force 2001a) using the nondestructive testing device.

c. Performing a condition survey to determine pavement distresses (type, severity and magnitude) in accordance with ASTM D 5340-93 and using analysis features of the Micro PAVER pavement management system.

The results of this study can be used to:

a. Provide preliminary engineering data for pavement design (Appendixes A and B).

b. Assist in identifying and forecasting maintenance and repair work, the preparation of long range work plans, and programming funds for the various work classification categories (Appendixes C and E).

c. Determine type and gross weights of aircraft that can operate on a given airfield feature without causing structural damage or shortening the life of the pavement structure (Appendix D).

d. Determine aircraft operational constraints as a function of pavement strength and surface condition (Appendix D).

e. Determine the need for structural improvements to sustain current levels of aircraft operations (Appendix D).

f. Summarize results for ISR ratings (Executive Summary).

Chapter 2 of this report includes the results of the aircraft classification number-pavement classification number (ACN-PCN) analysis for use by U.S. Army Aeronautical Services Agency (USAASA), the airfield commander, and Deputy Chief of Staff for Operations and Plans (DCSOPS) personnel. Chapter 3 contains maintenance, repair, and structural improvement recommendations for use by DPW personnel and design agencies. Chapter 4 contains conclusions and recommendations in summary form. Detailed supporting data are provided in the appendices.

2 Pavement Load-Carrying Capacity

General

The load-carrying capacity is a function of the strength of the pavement, the gross weight of the aircraft, and the number of applications of the load. The method used to report pavement load-carrying capacity is the ACN-PCN system as adopted by the International Civil Aviation Organization (ICAO). The United States, as a participating member of ICAO, is required to report pavement strength in this format. The ACN-PCN format also provides the airfield evaluation information required by Army Regulation AR 95-2 (Headquarters, Department of the Army 1990).

The ACN and PCN are defined as follows: The ACN is a number which expresses the relative structural effect of an aircraft on both flexible and rigid pavements for specific standard subgrade strengths in terms of a standard single wheel load. The PCN is a number which expresses the relative load-carrying capacity of a pavement for a given pavement life in terms of a standard single wheel load. An example of a PCN five part code is as follows:

49/F/A/W/T

- T — PCN derived from technical evaluation
- W — Tire pressure code W: High tire pressure (no limit)
- A — Subgrade strength A: High (CBR>13)
- F — Pavement type F: Flexible
- 49 — PCN = 49: Indication of load-carrying capacity. Example C-17 loaded to 263 Mg (580 kips)[1]

The system works by comparing the ACN to the PCN. The PCN is a representation of the allowable load for a specified number of repetitions over the life

[1] Most of the dimensions and measurements reported were obtained in non-SI units. All such values have been converted using the conversion factors given in ASTM E 621.

of a pavement. The ACN is a representation of the load applied by an aircraft using the pavement. The system is structured such that an aircraft operating at an ACN (applied load) equal to or less than the PCN (allowable load) would comply with load restrictions established based on a specified design life for the pavement facility. If, however, the ACN (applied load) is greater than the PCN (allowable load), the specified design life will be shortened due to this overloading. Pavements can usually support some overload; however, pavement life is reduced. As a general rule, ACN/PCN ratios of up to 1.25 have minimal impact on pavement life. If the ACN/PCN ratio is between 1.25 and 1.50, aircraft operations should be limited to 10 passes, and the pavement inspected after each operation. Aircraft operations resulting in an ACN/PCN ratio over 1.50 should not be allowed except for emergencies.

Load-Carrying Capacity

The first step in determining the load-carrying capacity of the pavements at Butts Army Airfield (BAAF), Fort Carson, Colorado, was to estimate the traffic to which the airfield will be subjected over the next 20 years. The C-130 was considered the design aircraft for the primary airfield fixed-wing facilities; Runway 13-31, Taxiways C and D, 13 and 31 Warm-up areas, the Hoverlane, Transient Parking Ramp, and Charlie Parking Ramp. All AC and PCC fixed-wing pavement facilities were evaluated for 6,000 passes of a C-130. All rotary-wing facilities were evaluated for 50,000 passes of a CH-47. Using this traffic information and results of the data analysis, the ACN value for the critical aircraft operating on the BAAF pavements was determined. The operational ACN for the airfield is 30/R/B/W/T for the rigid pavements and 30/F/C/W/T for the flexible pavements. See Table D5 for description of the five component ACN or PCN code. The numerical ACN values calculated for the critical aircraft operating on AC and PCC pavements on each of the four subgrade categories are presented in Table D2.

The critical PCN value for each airfield facility is presented in the Airfield Pavement Evaluation Chart (APEC) in Illustration 1. A summary of allowable loads and overlay requirements determined for the critical aircraft and its design pass level is shown in Table D3. PCN codes for the controlling feature of each facility are presented in Table D4. The effects of thaw-weakened conditions were considered and the results are summarized in Table D4.

The number of passes of mobilization and contingency aircraft loadings that could be sustained by each facility is dependent on the ACN of the aircraft and the critical PCN of the facility. During wartime, many aircraft are allowed to carry heavier loads than during peacetime. This allowance means that the aircraft would have a higher ACN because of the higher loading and would cause more damage per pass than in peacetime. Also, under some contingency plans or during emergencies, heavier aircraft than design aircraft (C-130) could be considered for using the airfield pavements. These heavier aircraft would generally have higher ACN values and cause more damage than those normally using the airfield. The operational life of the pavement will be reduced if it is subjected to aircraft loadings having ACN values higher than the PCN of the facility. An example of a procedure to determine the impact of mobilization and contingency aircraft operations is presented in Appendix D.

3 Recommendations for Maintenance, Repair, and Structural Improvements

General

Recommendations for maintenance, repair, and structural improvements are based on results from both the structural evaluation (Appendix D) and the pavement condition survey (Appendix C). Either or both the evaluation and/or the survey may indicate that a particular feature needs repair and/or improvement. If the pavement condition index (PCI) is below the required value contained in Army Regulation AR 420-72 (Headquarters, Department of the Army 2000), the pavement needs maintenance to improve its surface condition. If the ACN/ PCN ratio determined for the critical aircraft is greater than one, the pavement needs structural improvement. Where both evaluations indicate improvements are needed, the recommendations are made such that the repairs to the surface are those needed until the structural improvements can be made. If the structural improvements are made first, the surface repairs may not be necessary. The PCI, ACN/PCN, ISR rating, and recommended general maintenance alternatives for each feature are shown in Table 3-1, the Airfield Pavement Evaluation General Summary. Specific recommendations for maintenance are identified in Table 3-2.

The ISR is an information system designed to help the Army monitor some of the basic elements that affect the quality of life on installations. The ISR also supports decision-making by giving managers an objective means and a common methodology for comparing conditions across installations and across functional areas.

Recommendations for structural improvements have been defined in terms of overlays in this report. In some instances, overlays may not be the most cost effective or best engineering alternative for pavement strengthening. It should be noted that the overlay requirements shown in Table 3-2 were determined based on representative conditions at the time of testing and should be considered minimum values until verified by further investigation. These overlays should be used as a guide when programming funds for design projects. Reconstruction is recommended for all features with Very poor or lower PCI ratings and/or large overlay requirements. Prior to advertising an improvement project, a thorough pavement analysis and design should be completed to select the most cost-effective improvement technique. All designs should be reviewed by the U.S. Army Corps of Engineers Transportation Systems Center to ensure that they are in accordance with current design criteria.

Recommended overlay thicknesses follow the criteria for minimum thicknesses contained in UFC 3-260-02 (Headquarters, Departments of the Army, Navy, and the Air Force 2001b). Where calculated thicknesses are greater than the required minimum thickness, the values were rounded up to the next higher 13 mm (1/2-in.).

Maintenance and repair (M&R) recommendations are based on the changes needed to provide the minimum required PCI. AR 420-72 (Headquarters, Department of the Army 2000) states that installation airfield pavements shall be maintained to at least the following PCI:

All runways > 70
Primary taxiways 〈 60
Aprons and secondary taxiways > 55

Recommendations

Steps 1 through 5 of the flow chart shown in Figure 3-1 were used in determining the recommendations suggested in Table 3-2. The M&R alternatives suggested for the existing surfaces were selected from those listed for various distresses in flexible pavements shown in Table 3-3 and rigid pavements shown in Table 3-4. In many instances, the performance of a specific alternative depends upon the geographical location and expertise of local contractors. Therefore, it is suggested that the local DPW personnel review all recommendations. Local costs for the approved alternatives can then be used with the Micro PAVER program to obtain a reasonable cost estimate. All overlay, repair, or major repair should be in accordance with UFC 3-269-02 (Headquarters, Departments of the Army, Navy, and the Air Force 2001b) that specifies that the following pavements be rigid pavement: all paved areas on which aircraft or helicopters are regularly parked, maintained, serviced, or preflight checked, on hangar floors and access aprons; on runway ends (305 m (1,000 ft) of a Class B runway; primary taxiways for Class B runways; hazardous cargo, power check, compass calibration, warmup, alert, arm/disarm, holding, and washrack pads; and any other area where it can be documented that a flexible pavement will be damaged by jet blast or by spillage of fuel or hydraulic fluid.

The PCI was developed to determine maintenance and repair needs. If the PCI is low, maintenance or repair is needed to increase the PCI. If the PCI is low and the PCN is greater than the ACN, localized maintenance or repair will generally be an acceptable solution. Although these maintenance activities and repairs will improve the PCI to acceptable levels, they may not be the most cost-effective alternative. An overlay or other overall improvement may be more cost-effective than considerable localized maintenance or repairs. Certainly, if the current PCI is less than 25, overall improvements should be investigated. When an overlay is recommended, the maintenance recommended is that which is needed to keep the pavement serviceable and safe and its PCI at the required minimum until the overlay is applied. The PCN is used to specify the structural capability of an airfield pavement. If the design aircraft's ACN is larger than the computed PCN, the pavement is structurally inadequate to support the mission traffic. If only repairs to improve the PCI are applied, the pavement could deteriorate quite rapidly. Structural improvements are required to increase the load-carrying capacity so that the PCN is greater than or equal to the ACN (aircraft load). Even if the PCI is high, structural improvements are necessary to support the mission traffic if the PCN is less than the design ACN.

The PCIs of five runway features (R2A through R6A), five taxiway features (T1A, T3A through T6A), and one apron feature (A2B) fail to meet the minimum acceptable level outlined above. Due to the severity and quantity of surface distresses observed on the remaining ten features, maintenance or repair is not recommended. To meet the minimum PCI requirements resealing the joints, replacing the faulted slabs, and patching the medium- and high-severity spalls is recommended for T3A. The estimated cost is about $33,500. Although the PCI of ten features (A4B through A13B) meet the minimum PCI requirements, approximately $400,000 (FY 03) in M & R is recommended. M & R for these features include resealing the PCC joints, patching all medium- and high-severity spalls, and replacing all medium- and high-severity shattered, faulted, and "D" cracked slabs. An airfield pavements cost estimating guide for various maintenance and repair alternatives is shown in Table 3-4.

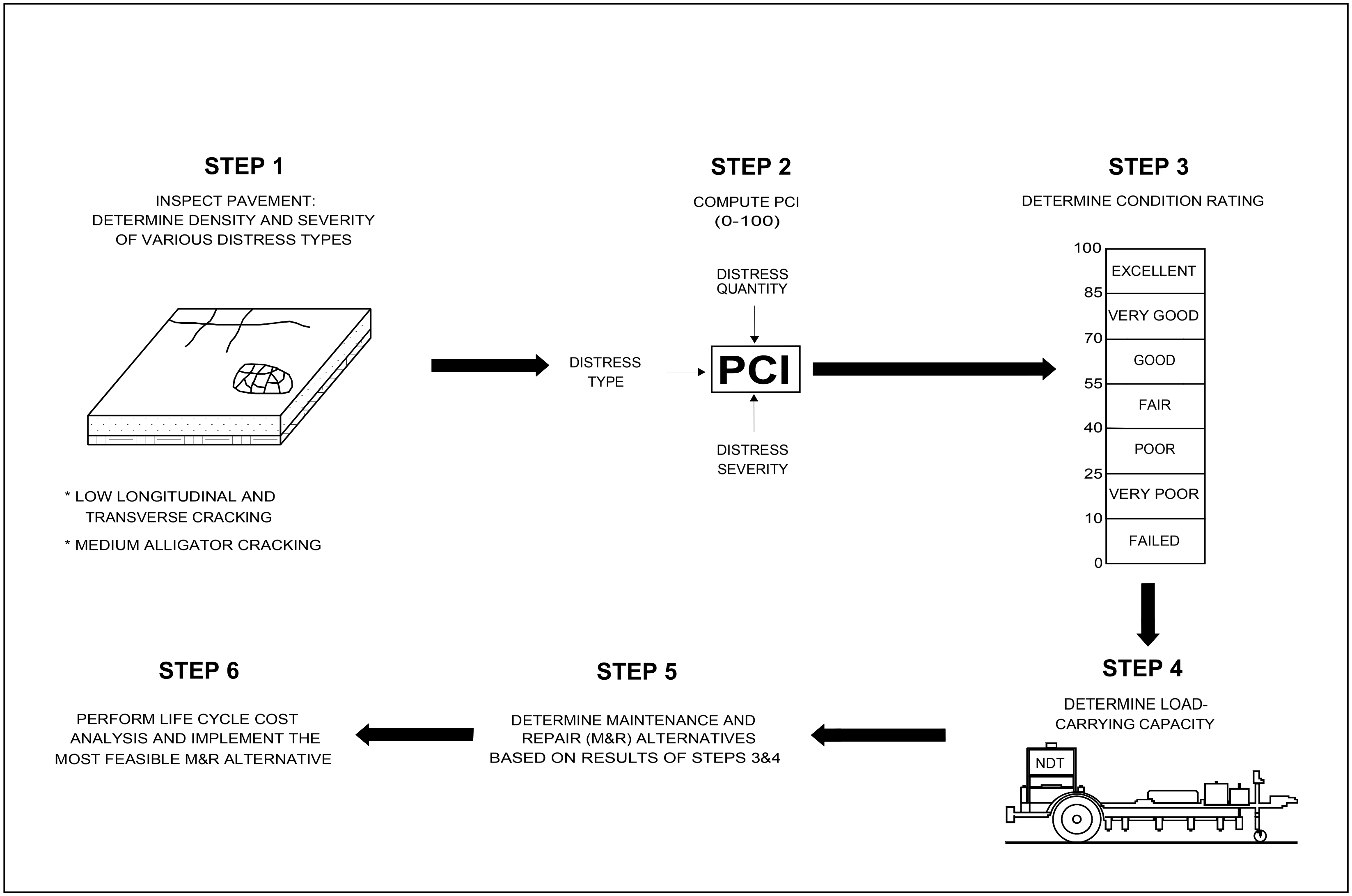

Figure 3-1. Flowchart for determination of maintenance and repair recommendations

Table 3-1
Airfield Pavement Evaluation General Summary

Pavement Feature	PCI	ACN/ PCN[2]	ISR Rating[3]	Work Classification[1] Do Nothing	Maintenance	Repair	Major Repair
R1A	92	2.73	Red				X
R2A	25	1.56	Red				X
R3A	14	2.00	Red				X
R4A	22	1.56	Red				X
R5A	26	1.56	Red				X
R6A	33	1.56	Red				X
R7A	93	1.15	Amber			X	
T1A	2	12.0	Red				X
T2A	90	1.11	Amber			X	
T3A	50	1.03	Red			X	
T4B	19	2.25	Red				X
T5A	5	2.25	Red				X
T6A	5	3.50	Red				X
A1B	92	1.07	Amber			X	
A2B	5	18.00	Red				X
A3B	93	2.55	Red			X	
A4B	82	1.50	Amber			X	
A5B	84	1.65	Red			X	
A6B	78	1.67	Red			X	
A7B	80	1.00	Green		X		
A8B	80	1.00	Green		X		
A9B	64	0.65	Amber		X		
A10B	84	1.00	Green		X		
A11B	85	1.10	Amber			X	
A12B	84	1.10	Amber			X	
A13B	81	1.00	Green		X		

[1] Work is categorized for preliminary planning purposes only. Classification of work for administrative approval is an installation responsibility. Policy guidance for airfield pavements is provided in AR 420-72. *Maintenance* is usually performed on paved areas with a PCI greater than the minimum required and encompasses primarily the day-to-day routine work. Maintenance includes items such as sealing cracks and joints, repairing potholes, patching, repairing spalls, and applying rejuvenators. *Repair* is the restoration of a failed or rapidly deteriorating section of pavement to a good or excellent condition to such that it may be utilized for its designated purpose. Repair is usually applied to pavements with a PCI less than the minimum required. Examples are: recycling, overlays, slab replacement, and repairing drainage structures. *Major repair (construction)* relates to the alteration, extension, replacement, or upgrading of an existing facility. Major repair examples include: widening or lengthening a surfaced area, strengthening a pavement to support a new mission, and replacement of an entire facility.
[2] Determined for design aircraft.
[3] Based on the PCI and ACN/PCN ratio of the pavement feature.

Table 3-2
Summary of Overlay and Maintenance Requirements for the Day-to-Day Traffic Operations

Feature	Area Sq m (sq yd)	Overlay Requirements, mm (in.)[1] AC	PCC Partial Bond	PCC with no Bond	Maintenance and Repair Alternatives for Existing Surfaces
Runway 13-31					
R1A[2]	3484 (4,167)	140 (5.5)	NA	See[3]	The PCI of this feature is above that required for runways. However, it is structurally inadequate to support the design traffic. Overlaying with AC is not recommended. PCC reconstruction should be considered if this feature is to withstand the projected traffic.
R2A[2]	3484 (4,167)	51 (2.0)	NA	See[3]	The PCI of this feature is far below that required for runways and the existing pavement is structurally inadequate to support the design traffic. Crack sealing, surface sealing, patching, and/or overlaying are not recommended. PCC reconstruction should be considered if this feature is to withstand the projected traffic.
R3A	3484 (4,167)	51 (2.0)	NA	See[3]	Same as for R2A.
R4A	17 837 (21,333)	51 (2.0)	NA	See[3]	The PCI of this feature is far below that required for runways and the existing pavement is structurally inadequate to support the design traffic. Crack sealing, surface sealing, patching, and/or overlaying are not recommended. Reconstruction should be considered if this feature is to withstand the projected traffic.
R5A[2]	3484 (4,167)	51 (2.0)	NA	See[3]	Same as for R2A.
R6A[2]	2787 (3,333)	51 (2.0)	NA	See[3]	Same as for R2A.
R7A[2]	1359 (1,625)	NA	152 (6.0)	165 (6.5)	The PCI of this feature is above that required for runways. However, it is structurally inadequate to support the design traffic. PCC reconstruction should be considered if this feature is to withstand the projected traffic.
Taxiway B					
T1A	4877 (5,833)	--[4]	--[4]	--[4]	The PCI of this feature is far below that required for taxiways and the existing pavement is structurally inadequate to support the design traffic. The PCI rating of T1A is failed. Therefore, M & R is not recommended. Reconstruction is required if this feature is to withstand the projected traffic.
Taxiway C					
T2A[2]	1858 (2,222)	NA	152 (6.0)	152 (6.0)	The PCI of this feature is above that required for taxiways. However, structural improvements are required in order for the pavement to withstand the design traffic.
T6A[2]	881 (1,053)	140 (5.5)	NA	See[3]	Same as for T1A.
Taxiway D					
T3A[2]	2750 (3,289)	NA	152 (6.0)	152 (6.0)	Increase the PCI to an acceptable level by cleaning and sealing the joints with a high-quality sealer,[5] replacing the faulted slabs, and patching the medium- and high-severity spalls with an epoxy concrete patch or a full-depth patch. Structural improvements are required to withstand the design traffic.

(Sheet 1 of 3)

1 For planning purposes only.
2 UFC 3-260-02 (Headquarters, Departments of the Army, Navy, and the Air Force 2001b) requires that the pavement be a rigid pavement.
3 Was not calculated because feature was evaluated as a flexible pavement.
4 Reconstruction is recommended because the ISM is less than the lower limit of LOW.
5 See TM 5-882-11/AFP 88-6, Chapter 7 (Headquarters, Departments of the Army and Air Force 1993) for guidance.

Table 3-2 (Continued)

Feature	Area Sq m (sq yd)	Overlay Requirements, mm (in.)[1]			Maintenance and Repair Alternatives for Existing Surfaces
		AC	PCC Partial Bond	PCC with no Bond	
Compass Rose Taxiway					
T4B	780 (933)	51 (2.0)	NA	See[3]	The PCI of this feature is below that required for taxiways and the existing pavement is structurally inadequate to support the projected traffic. Due to the very poor surface condition and structural condition, M & R is not recommended. Reconstruction should be considered.
Alpha Lane					
T5A	18 812 (22,500)	51 (2.0)	NA	See[3]	The PCI of this feature is far below that required for hoverlanes and the existing pavement is structurally inadequate to support the design traffic. The PCI rating of T5A is failed. Due to the surface condition and structural condition, M & R is not recommended. Reconstruction should be considered.
13 Warm-up					
A1B[2]	3902 (4,667)	NA	152 (6.0)	152 (6.0)	The PCI of this feature is above that required for aprons. Structural improvements are required. A PCC overlay or PCC reconstruction should be considered if this feature is to withstand the projected traffic.
31 Warm-up					
A2B[2]	4854 (5,806)	254 (10.0)	NA	See[3]	The PCI of this feature is far below that required for warm-up areas and the existing pavement is structurally inadequate to support the design traffic. The PCI rating of A2B is failed. Due to the surface condition and structural condition, M & R is not recommended. Reconstruction should be considered.
Hoverlane					
A3B[2]	22 993 (27,500)	76 (3.0)	NA	See[3]	The PCI of this feature is above that required for hoverlanes. Structural improvements are required to withstand the projected traffic. If this feature is required to sustain C-130 traffic, reconstruction with PCC should be considered.
Transient Parking Ramp					
A4B[2]	4139 (4,950)	NA	152 (6.0)	191 (7.5)	The PCI of this feature is above that required for parking areas. However, it is recommended that joints be cleaned and sealed with a high quality-quality sealant.[5] PCC reconstruction is recommended if this feature is to withstand the projected traffic.
Charlie Parking Ramp					
A5B[2]	12 646 (15,125)	NA	165 (6.5)	203 (8.0)	Same as for A4B.
A6B[2]	19 161 (22,917)	NA	178 (7.0)	216 (8.5)	The PCI of this feature is above that required for parking areas. However, it is recommended that joints be cleaned and sealed with a high quality-quality sealant,[5] the high- and medium-severity spalls be repaired with an epoxy concrete patch or a full-depth patch, the slabs with high- and medium-severity "D" cracking and/or large patches be replaced. PCC reconstruction is recommended if this feature is to withstand the projected traffic.
					(Sheet 2 of 3)

1 For planning purposes only.
2 UFC 3-260-02 (Headquarters, Departments of the Army, Navy, and the Air Force 2001b) requires that the pavement be a rigid pavement..
3 Was not calculated because feature was evaluated as a flexible pavement.
4 Reconstruction is recommended because the ISM is less than the lower limit of LOW.
5 See TM 5-882-11/AFP 88-6, Chapter 7 (Headquarters, Departments of the Army and Air Force 1993) for guidance.

Table 3-2 (Concluded)

Feature	Area Sq m (sq yd)	Overlay Requirements, mm (in.)[1] AC	PCC Partial Bond	PCC with no Bond	Maintenance and Repair Alternatives for Existing Surfaces
Delta Parking Ramp					
A7B[2]	4674 (5,590)	NA	0 (0.0)	0 (0.0)	The PCI of this feature is above that required for aircraft parking areas. However, it is recommended that joints be cleaned and sealed with a high-quality sealant[5] and all high-severity "D" cracked slabs be replaced.
A8B[2]	5661 (6,771)	NA	0 (0.0)	0 (0.0)	The PCI of this feature is above that required for aircraft parking areas. However, it is recommended that the joints be cleaned and then sealed with a high-quality sealant.[5]
A9B[2]	26 909 (32,184)	NA	0 (0.0)	0 (0.0)	The PCI of this feature is above that required for parking areas. However, it is recommended that joints be cleaned and sealed with a high quality-quality sealant,[5] the high- and medium-severity spalls be repaired with an epoxy concrete patch or a full-depth patch, the slabs with high-severity "D" cracking and faulted slabs be replaced.
B East Parking Ramp					
A10B[2]	4982 5,958)	NA	0 (0.0)	0 (0.0)	The PCI of this feature is above that required for parking areas. However, it is recommended that joints be cleaned and sealed with a high quality-quality sealant[5] and that the high- and medium-severity faulted slabs be replaced.
B West Parking Ramp					
A11B[2]	4982 5,958)	NA	152 (6.0)	152 (6.0)	The PCI of this feature is above that required for parking areas. However, it is recommended that joints be cleaned and sealed with a high quality-quality sealant[5] and that the shattered slabs be replaced. Structural improvements are required to withstand the projected traffic.
Compass Rose					
A12B[2]	929 (1,111)	NA	152 (6.0)	165 (6.5)	The PCI of this feature is above that required for compass calibration areas. However, it is recommended that joints be cleaned and sealed with a high quality-quality sealant.[5] Structural improvements are required to withstand the projected traffic.
Alpha Ramp					
A13B[2]	59 990 (71,850)	NA	0 (0.0)	0 (0.0)	The PCI of this feature is above that required for parking areas. However, it is recommended that the high- and medium-severity spalls be repaired with an epoxy concrete patch or a full-depth patch and that the faulted slabs be replaced.

(Sheet 3 of 3)

[1] For planning purposes only.
[2] UFC 3-260-02 (Headquarters, Departments of the Army, Navy, and the Air Force 2001b) requires that the pavement be a rigid pavement.
[3] Was not calculated because feature was evaluated as a flexible pavement.
[4] Reconstruction is recommended because the ISM is less than the lower limit of LOW.
[5] See TM 5-882-11/AFP 88-6, Chapter 7 (Headquarters, Departments of the Army and Air Force 1993) for guidance.

Table 3-3
Maintenance, Repair, and Major Repair Alternatives for Airfield Pavements, Flexible

	Maintenance				Repair												Major Repair		
Distress Type	Seal Minor Cracks	Repair Pot-Holes	Partial-Depth Patching	Apply Rejuve-nators[1]	Seal Major Cracks	Full-Depth Patching	Micro-Surfacing	Slurry Seal[2]	Thin AC Overlays[3]	Surface Milling	Grooving	Porous Friction Course	Repair Drainage Facilities[4]	Surface Recycling	AC Structural Overlay[3]	PCC Structural Overlay	Remove Existing Surface and Reconstruct	Hot Recycle	Cold Recycle
Alligator cracking	L	M,H	M			M,H	L	L					L,M,H		M,H	M,H	H		
Bleeding										A				A			A	A	A
Block cracking	L,M			L	M,H		L,M	L						M	M,H			M,H	M,H
Corrugation			L,M			L,M,H	L,M		M,H	L,M							M,H		
Depression			L,M,H			M,H	L		M,H				L,M,H				H		
Jet blast				A		A	A		A										
Reflection cracking	L,M				M,H		L,M	L							M,H			H	
Longitudinal and transverse cracking	L,M				M,H		L,M	L							M,H			H	
Oil spillage			A			A			A	A				A			A	A	
Patching	L,M		M		M	M,H									M,H		H	H	
Polished aggregate							A	A	A	A	A	A		A					
Raveling/weathering		M,H		L,M		M	L,M	L	M,H	M				M,H		H	H	M,H	
Rutting			L,M			L,M,H	L						L,M,H		M,H	H	H	M,H	
Shoving			L			L,M				L,M							M,H	M,H	
Slippage cracking	A		A		A	A									A		A	A	
Swell			L,M			M,H				L,M			L,M,H				H		

Note: L = low severity level; M = medium severity level; H = high severity level; A = no severity levels for this distress.

[1] Not to be used on high speed areas due to increased skid potential.

[2] Not to be used on heavy traffic areas.

[3] Patch distressed areas prior to overlay.

[4] Drainage facilities to be repaired as needed.

Table 3-4
Maintenance, Repair, and Major Repair Alternatives for Airfield Pavements, Rigid

	Maintenance				Repair											Major Repair	
Distress Type	Seal Minor Cracks	Joint Seal	Partial Patch	Epoxy Patch	Seal Major Cracks	Full-Depth Patch	Under Sealing	Slab Grind-ing	Surface Milling	AC Overlay	PCC Overlay	Slab Replace-ment	Crack & Seat with AC Struc-tural Overlay	AC Overlay w/ Geotextile	Repair/ Install Surface/ Subsurface Drainage System[1]	PCC Recycling	Remove Existing PCC and Reconstruct
Blowup			L,M			M,H						H					
Corner break	L			M,H	M,H	M,H						H					
Longitudinal/ Transverse/ Diagonal cracking	L,M				M,H					H	H	H	M,H	H	L,M,H	H	H
D cracking	L		M,H		M,H	H						H				H	H
Joint seal damage		M,H															
Patching (small) <5 ft^2	L,M		M	L,M	M,H	M,H						H					
Patching/utility cut	L,M		M	L,M	M,H	M,H						H					H
Popouts[2]				A						A	A						
Pumping	A	A			A		A								A		
Scaling/map cracking			M,H					M,H		M,H	M,H						
Fault/settlement		L,M					M,H	L,M	M,H						L,M,H		
Shattered slab	L				L,M					M,H	M,H	M,H		H	L,M,H	H	H
Shrinkage crack[3]																	
Spalling (joints)		L	L,M	L,M,H	M,H	M,H											
Spalling (corner)			L,M	L,M	M,H	M,H											

Note: L = low severity level; M = medium severity level; H = high severity level; A = no severity levels for this distress.

[1] Drainage facilities to be repaired as needed.

[2] Popouts normally do not require maintenance.

[3] Shrinkage cracks normally do not require maintenance.

Table 3-5
Airfield Pavements M&R Cost Estimating Guide

Item	Description	U/M	Unit Cost ($)					
			FY02	FY03	FY04	FY05	FY06	FY07
1	Remove/replace 10" PCC w/14" PCC including 6" base	SY	74.92	76.80	78.71	80.68	82.70	84.76
2	PCC Construction	SY-IN	3.87	3.92	4.02	4.12	4.22	4.33
3	Remove/replace 6" Bituminous Pavement w/14" PCC including 6" base	SY	68.69	70.41	72.17	73.97	75.82	77.71
4	Asphalt Concrete Overlay							
	-- Airfield Mix	TONS	52.89	54.21	55.57	56.95	58.37	59.83
		SY-IN	2.87	2.94	3.01	3.09	3.17	3.25
	-- Highway Mix	TONS	48.71	49.92	51.17	52.45	53.76	55.10
		SY-IN	2.65	2.71	2.78	2.85	2.92	2.99
5	Joint Resealing (JFR)	LF	2.25	2.30	2.36	2.42	2.48	2.54
6	Joint Resealing (NON - JFR)	LF	2.00	2.05	2.10	2.15	2.20	2.26
7	Crack Routing/Sealing (PCC)	LF	2.76	2.83	2.90	2.97	3.04	3.12
8	Neoprene Compression Joint Seal							
	-- Saw Cutting Only	LF	1.40	1.43	1.47	1.50	1.54	1.56
	-- Lubrication, Furnish and Install Compression Seal							
	-- 1/2-in. wide joint	LF	3.47	3.55	3.64	3.73	3.82	3.92
	-- 5/8-in. wide joint	LF	3.85	3.94	4.04	4.14	4.24	4.35
	-- 3/4-in. wide joint	LF	4.72	4.84	4.96	5.09	5.22	5.35
9	Spall Repairs (Epoxy-Bonded PCC)	SF	26.58	27.25	27.93	28.63	29.35	30.08
10	PCC Pavement Removal (To Base Course) T < 12"	SY-IN	1.06	1.09	1.12	1.15	1.18	1.21
11	PCC Pavement Removal (To Base Course) T ▲ 12"	SY-IN	1.50	1.53	1.57	1.61	1.65	1.69
12	Asphalt Pavement Removal (to base course)	SY-IN	0.97	0.99	1.01	1.04	1.07	1.09
13	Base/Subgrade Removal	SY-IN	0.64	0.66	0.66	0.69	0.71	0.72
14	Asphalt Milling/Profiling/Grinding (Cold)							
	-- up to 1-in. depth	SY	1.64	1.68	1.72	1.77	1.81	1.86
	-- up to 2-in. depth	SY	2.37	2.43	2.49	2.55	2.61	2.68
	-- up to 3-in. depth	SY	2.50	2.56	2.62	2.69	2.76	2.83
	-- up to 4-in. depth	SY	2.63	2.69	2.76	2.83	2.90	2.97
	-- small difficult jobs (hard agg. etc.)	SY-IN	3.12	3.20	3.28	3.36	3.44	3.53
15	PC Concrete Grinding/Profiling (Normally 1/2 in. is max Feasible)	SY-IN	19.98	20.48	20.99	21.52	22.06	22.61
16	Heater-Scarification (3/4--") - rejuvenation	SY	1.39	1.42	1.46	1.49	1.53	1.57
17	Cold Recycling 6" AC with 4-in.-thick AC O/L	SY	18.34	18.80	19.27	19.75	20.24	20.75
18	Slurry Seal	SY	1.65	1.69	1.73	1.78	1.82	1.87

(Continued)

Table 3-5 (Concluded)								
			Unit Cost ($)					
Item	Description	U/M	FY02	FY03	FY04	FY05	FY06	FY07
19	Micro-Surfacing	SY	2.37	2.43	2.49	2.55	2.61	2.68
20	Single Bituminous Surface Treatment	SY	2.00	2.05	2.10	2.15	2.20	2.26
21	Double Bituminous Surface Treatment	SY	2.89	2.96	3.03	3.11	3.19	3.27
22	Rubberized Coal Tar Pitch Emulsion Sand Slurry Surface Treatment	SY	1.81	1.85	1.90	1.94	1.99	2.04
23	Rubberized Coal Tar Pitch Emulsion (No Aggregate)	SY	1.19	1.22	1.25	1.28	1.31	1.34
24	Fog Seal	SY	0.81	0.83	0.85	0.87	0.89	0.91
25	Rubberized Asphalt Systems							
	-- Stress Absorbing Membrane (SAM) Interlayer	SY	4.62	4.74	4.86	4.98	5.10	5.23
	-- SAM Seal Coat (uncoated chips)	SY	4.87	5.00	5.13	5.25	5.38	5.52
	-- SAM Seal Coat (precoatedchips)	SY	5.24	5.37	5.50	5.64	5.78	5.93
26	Reinforcing Fabric Membranes (including tack coat)	SY	2.60	2.66	2.73	2.79	2.86	2.93
27	Elastomeric Inlay installed in Existing PCC, Complete (2' Wide X 100' Long X 2" Deep)	EA	26.3K	26.9K	27.6K	28.3K	29.0K	29.7K
28	PC Concrete Inlay (20' X 120' X 12" in Asphalt Pavement)	EA	18.7K	19.2K	19.7K	20.2K	20.7K	21.2K
29	Runway Grooving							
	-- Asphalt Concrete Pavement	SY	2.00	2.05	2.10	2.15	2.20	2.26
	-- Portland Concrete Pavement	SY	4.37	4.48	4.59	4.71	4.83	4.95
30	Runway Rubber Removal (High Pressure Water Blasting Method)	SF	0.062	0.063	0.065	0.066	0.067	0.069
31	Paint Removal							
	-- Partial Removal (Remove only loose, flaking, or poorly bonded paint)	SF	0.062	0.063	0.065	0.066	0.067	0.069
	-- Complete Removal (Using High Pressure water with sand injection)	SF	0.72	0.74	0.76	0.78	0.80	0.82
32	Airfield Marking							
	-- Reflectorized	SF	0.48	0.50	0.51	0.53	0.54	0.56
	-- Non-Reflectorized	SF	0.27	0.28	0.29	0.29	0.30	0.30
33	Street Marking							
	-- Reflectorized	SF	0.35	0.36	0.37	0.38	0.39	0.40
	-- Non-Reflectorized	SF	0.22	0.23	0.24	0.24	0.25	0.25
34	Random Slab Replacement							
	-- 12' by 12' by 12-in. thick	EA	1.3K	1.3K	1.3K	1.4K	1.4K	1.5K
	-- 25' by 25' by 12-in. thick	EA	5.0K	5.2K	5.3K	5.5K	5.6K	5.8K
	-- 25' by 25' by 18-in. thick	EA	7.5K	7.6K	7.8K	8.0K	8.2K	8.4K
	-- 25' by 25' slab	SY-IN	5.84	5.99	6.14	6.29	6.45	6.61
35	Soil Cement Stabilization (10 percent by weight)	SY-IN	0.53	0.54	0.55	0.57	0.58	0.60

4 Conclusions

The maintenance and rehabilitation alternatives discussed in Chapter 3 and summarized in Table 3-2 should be performed as soon as possible to retain the full benefit of the structural capacity of the existing pavements. The M & R alternatives suggested for the existing surfaces were selected from the alternatives listed for the various distresses shown in Tables 3-3 and 3-4. In many instances the performance of a specific alternative is dependent upon local conditions and contractors.

The operational ACN for the airfield rigid pavement facilities is 30/R/B/W/T and for the flexible pavement facilities 30/F/C/W/T. PCNs for each facility are shown in Illustration 1. ISR ratings based on the ACN/PCN ratios and the PCIs of each respective facility are shown in Illustration 2.

PCN's for the controlling feature of each pavement facility during the thaw-weakened periods are provided in Table D4 as guidance to the airfield operator for managing airfield operations during the November through March time frame.

References

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________. (2001b). “Pavement design for airfields,” Unified Facilities Criteria, UFC 3-260-02, Washington, DC.

Appendix A
Background Data

Description of the Airfield

Butts Army Airfield (BAAF) is located at Fort Carson, Colorado, in El Paso County and is approximately 11.3 km (7 miles) south of Colorado Springs, CO. The airfield is located on a gently rolling prairie with sharply rising mountains 9.7 km (6 miles) to 16.1 km (10 miles) west of the airfield. The elevation of the airfield is 1,789 m (5,871 ft) above mean sea level. The soils in the area consist of sand and gravel deposits with some Aeolian deposits consisting of clayey sandy silt. The principal soil types of the airfield site are classified as sandy clays and sands.

A layout of the airfield is shown in Figure A1. Pavement feature identifications and locations are shown in Figure A2. In May 2002 the airfield consisted of one active runway (13-31), an old runway now used as a hoverlane (Alpha Lane), various parking aprons, connecting taxiways, warm-up areas, and a compass rose. Runway 13-31 was 1402 m (4,600 ft) long and 23 m (75 ft) wide. The Alpha Lane is 23 m (75 ft) wide and 823 m (2700 ft) long.

The climatological data used herein were obtained from the weather station at Fort Carson, CO. The annual rainfall in the area is about 335 mm (13.2 in.) and the annual snowfall is 719 mm (28.3 in.). The maximum and minimum temperatures were 38°C and –29°C (100°F and -20°F), respectively. Temperature and precipitation data are summarized in Table A1.

Previous Reports

Pertinent data for use in this evaluation were extracted from the previous reports listed below:

a. U.S. Army Engineer Waterways Experiment Station, "Airfield Pavement Evaluation, Butts Army Airfield, Fort Carson, Colorado," Miscellaneous Paper GL-96-19, August 1996, Vicksburg, MS.

b. U.S. Army Engineer Waterways Experiment Station, "Airfield Pavement Evaluation, Butts Army Airfield, Fort Carson, Colorado," Miscellaneous Paper GL-94-35, August 1994, Vicksburg, MS.

c. U.S. Army Engineer Waterways Experiment Station, "Condition Survey, Butts Army Airfield, Fort Carson, Colorado," Miscellaneous Paper GL 89-23, September 1989, Vicksburg, MS.

d. U.S. Army Engineer Waterways Experiment Station, "Airfield Pavement Evaluation, Butts Army Airfield, Fort Carson, Colorado," Miscellaneous Paper S-85-17, August 1985, Vicksburg, MS.

e. U.S. Army Engineer Waterways Experiment Station, "Airfield Pavement Evaluation, Butts Army Airfield, Fort Carson, Colorado," Miscellaneous Paper S-76-22, November 1976, Vicksburg, MS.

f. U.S. Army Engineer Waterways Experiment Station, "Condition Survey, Butts Army Airfield, Fort Carson, Colorado," Miscellaneous Paper S-72-26, June 1972, Vicksburg, MS.

g. U.S. Army Engineer Division Ohio River, "Pavement Evaluation, Butts Army Airfield, Fort Carson, Colorado," October 1960, Cincinnati, OH.

h. U.S. Army Engineer Waterways Experiment Station, "Army Airfield Pavement Evaluation, Butts Army Airfield, Fort Carson, Colorado," Technical Report No.3-466, July 1960, Vicksburg, MS.

Design and Construction History

The original pavements at BAAF were constructed in 1954 and consisted of a steel-plank landing mat runway and hardstands that have since been removed. Upgrading the pavement, including new construction and repair of the existing facilities, was performed at various periods from 1958 through 2001. The overrun for Runway 13-31 and the Taxiway Bravo were constructed in 1960. Alpha Lane, the Warm-Up Ramps, the Compass Rose and taxiway, the Hover Lane, and the 178 mm (7 in.) thick Portland cement concrete portion of the Charlie Parking Ramp were constructed in 1964. Taxiway Delta, the 229 mm (9 in.) thick portion of the Delta Parking Ramp, and both Bravo East and West Rotary-wing Parking Ramps were constructed in 1981. The Alpha Ramp was constructed in 1991. In 2001, the Hoverlane was reconstructed with 4 in. of base and 4 in. of AC for a total of 8 in. The same year the North Overrun was reconstructed with the same 4/4, and an 8-in.-thick, 43-m- (143-ft-) long PCC addition was constructed on the South end of the runway. This PCC addition was to be used for a C-130 turnaround area. Table A2 presents the history of the major construction activities at BAAF. A summary of the physical property data of the various pavement features is shown in Table A3.

Traffic History

The fixed-wing facilities (Runway 13-31, Charlie taxiway and ramp, Transient Ramp, Delta taxiway, and 13 Warm-up Ramp) were evaluated for 6,000 passes of a 70 300 kg (155,000 lb) C-130 aircraft. Traffic logs for the past three years indicate approximately 300 annual landings of a C-130. All other features were evaluated for 50,000 passes of a 22 700 kg (50,000 lb) CH-47 rotary-wing aircraft.

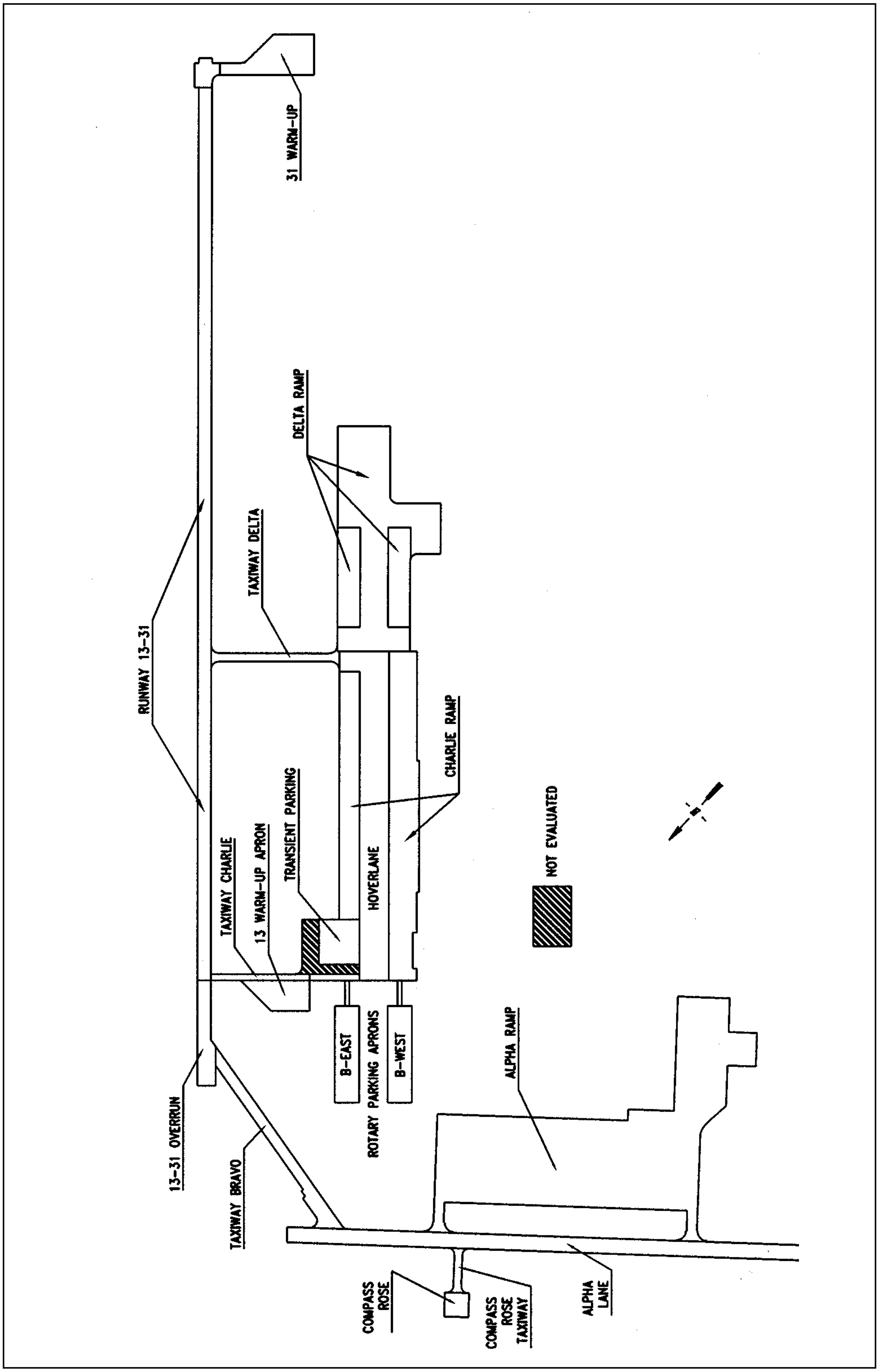

Figure A1. Layout of airfield and facility identifications

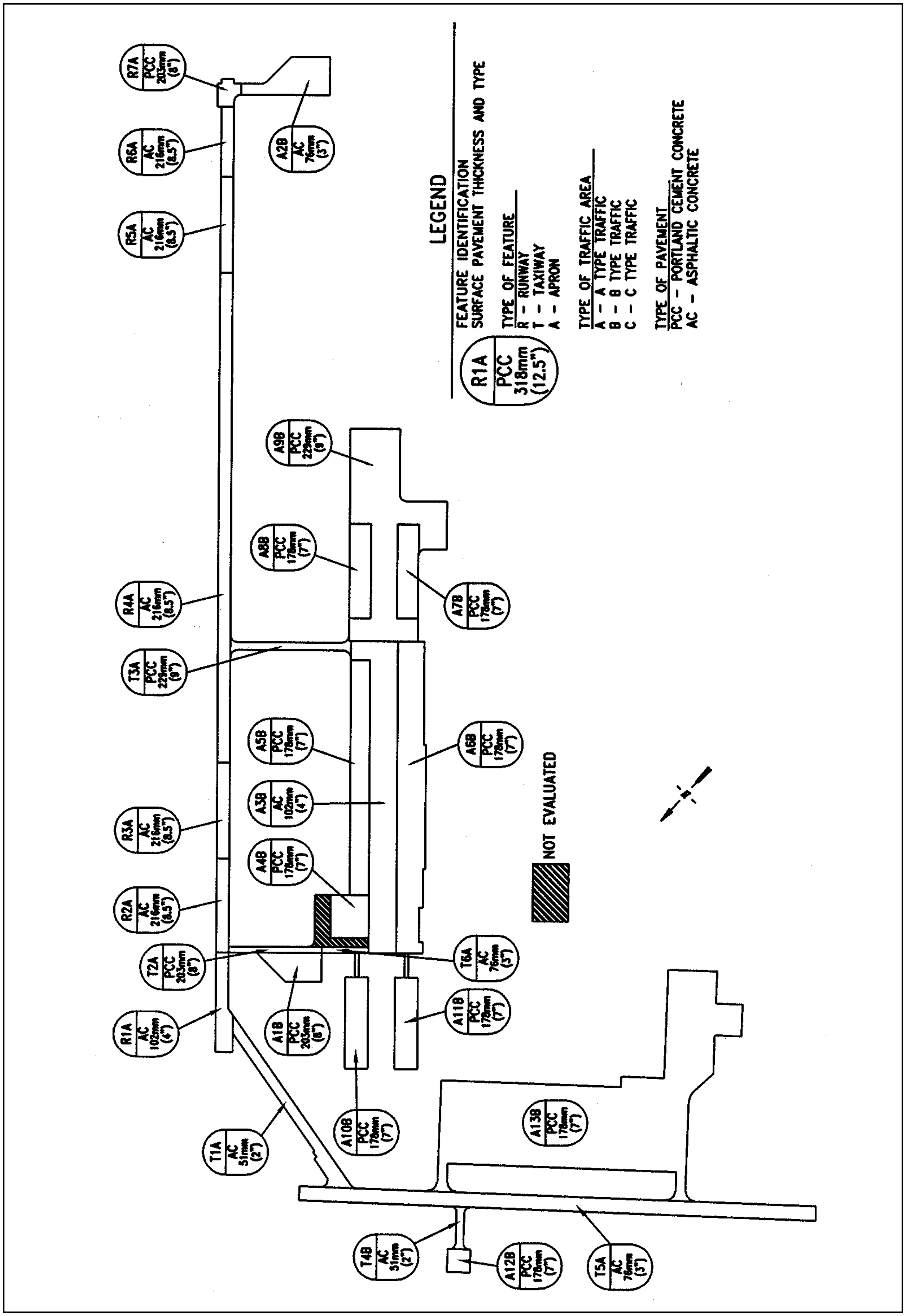

Figure A2. Pavement feature identification and location

Table A1
Climatological Data Summary

	J	F	M	A	M	J	J	A	S	O	N	D	ANN	YRS REC
Temperature, °C (°F)														
Highest	23 (73)	23 (73)	26 (79)	31 (87)	33 (92)	38 (100)	37 (99)	38 (100)	34 (93)	31 (87)	26 (78)	23 (73)	38 (100)	22
Mean Daily Max	6 (43)	8 (47)	12 (54)	16 (62)	21 (70)	27 (80)	30 (86)	28 (83)	25 (77)	19 (67)	12 (53)	7 (45)	18 (64)	22
Mean	0 (32)	2 (35)	6 (42)	10 (50)	14 (58)	21 (69)	23 (74)	22 (72)	18 (64)	12 (54)	5 (41)	2 (35)	12 (53)	22
Mean Daily Min	-6 (22)	-4 (24)	-1 (31)	3 (37)	8 (46)	13 (55)	16 (60)	15 (59)	11 (52)	6 (42)	-1 (31)	-4 (25)	5 (41)	22
Lowest	-23 (-10)	-25 (-13)	-17 (2)	-15 (5)	-5 (23)	2 (36)	8 (47)	3 (38)	-3 (27)	-14 (7)	-19 (-3)	-29 (-20)	-29 (-20)	22
Precipitation, mm (in.)														
Mean	5 (0.2)	10 (0.4)	23 (0.9)	33 (1.3)	33 (1.3)	48 (1.9)	79 (3.1)	58 (2.3)	33 (1.3)	20 (0.8)	15 (0.6)	5 (0.2)	335 (13.2)	22
Snowfall, mm (in.)														
Mean	107 (4.2)	125 (4.9)	193 (7.6)	102 (4.0)	5 (0.2)	0	0	0	20 (0.8)	38 (1.5)	119 (4.7)	71 (2.8)	719 (28.3)	22
Relative Humidity, %														
Mean 0400 LST 1400 LST	66 42	64 39	66 36	69 33	72 36	66 32	69 31	68 34	66 32	58 30	63 36	59 39	66 35	22

Source of data: www.afccc.af.mil/climo Fort Carson, Colorado

Table A2
Construction History

Pavement Facility (Feature)	Surface Pavement Thickness, mm (in.)	Surface Pavement Type	Construction Date
Runway 13-31			
R2A, R6A	686 (27.0)[1]	AC	1959
R3A, R4A, R5A	533 (21.0)[1]	AC	1959
R2A, R3A, R4A, R5A, R6A	25 (1.0)[2]	AC	1965
R2A, R3A, R4A, R5A, R6A	38 (1.5)[2]	AC	1969
R2A, R3A, R4A, R5A, R6A	25 (1.0)[2]	AC	1973
R2A, R3A, R4A, R5A, R6A	51 (2.0)[2]	AC	1986
R7A	203 (8.0)[4]	PCC	2001
Runway 13-31 Overrun			
R1A	254 (10.0)[1]	BST[3]	1960
R1A	25 (1.0)[2]	AC	1973
R1A	102 (4.0)[4]	AC	2001
Alpha Lane			
T5A	406 (16.0)[1]	AC	1964
T5A	25 (1.0)[2]	AC	1973
Taxiway B			
T1A	254 (10.0)[1]	BST	1960
T1A	25 (1.0)[2]	AC	1973
Taxiway C			
T2A	406 (16.0)[1]	AC	1964
T2A	25 (1.0)[2]	AC	1973
T2A	203 (8.0)[4]	PCC	2001
T6A	406 (16.0)[1]	AC	1964
T6A	25 (1.0)[2]	AC	1973
Taxiway D			
T3A	229 (9.0)	PCC	1981
Compass Rose Taxiway			
T4B	406 (16.0)[1]	AC	1964
13 Warm-Up Ramp			
A1B	406 (16.0)[1]	AC	1964
A1B	25 (1.02)[2]	AC	1973
31 Warm-Up Ramp			
A2B	406 (16.0)[1]	AC	1964
A2B	25 (1.0)[2]	AC	1973
Hoverlane			
A3B	406 (16.0)[1]	AC	1964
A3B	25 (1.0)[2]	AC	1973
A3B	102 (4.0)[4]	AC	2001
Transient Parking Ramp			
A4B	178 (7.0)	PCC	1964
Charlie Parking Ramp			
A5B	178 (7.0)	PCC	1981
A6B	178 (7.0)	PCC	1981
Delta Parking Ramp			
A7B	178 (7.0)	PCC	1981
A8B	178 (7.0)	PCC	1981
A9B	229 (9.0)	PCC	1981

(Continued)

[1] Thickness includes surface course, base, and subbase.
[2] Overlay pavement.
[3] Bituminous surface treatment and base.
[4] Reconstruction.

Table A2 (Concluded)			
Pavement Facility (Feature)	**Surface Pavement**		**Construction Date**
	Thickness, mm (in.)	**Type**	
B East parking Ramp A10B	178 (7.0)	PCC	1981
B West parking Ramp A11B	178 (7.0)	PCC	1981
Compass Rose A12B	178 (7.0)	PCC	1981
Alpha Ramp A13B	178 (7.0)	PCC	1981

[1] Thickness includes surface course, base, and subbase.
[2] Overlay pavement.
[3] Bituminous surface treatment and base.
[4] Reconstruction.

Table A3
Summary of Physical Property Data

Facility					Overlay Pavement			Pavement			Base			Subbase			Subgrade	
Feature	Identification	Length m (ft)	Width m (ft)	General Condition PCI	Thickness[1] mm (in.)	Description	Flex. Str.[1] MPa (psi)	Thickness[1] mm (in.)	Description	Flex. Str.[1] MPa (psi)	Thickness[1] Mm (in.)	Description	Modulus[2] MPa (psi)	Thickness[1] mm (in.)	Description	Modulus[2] MPa (psi)	Description	Modulus[2] MPa (psi)
Fixed-Wing Facilities																		
R1A	Runway 13-31 Overrun	152 (500)	23 (75)	Excellent				102 (4.0)	AC		102 (4.0)	Aggregate Base (GW)	34[4]	76 (3.0)	Gravel (GP)	34[4]	Sandy Clay (CL)	6[4]
R2A	Runway 13-31	152 (500)	23 (75)	Very poor	140 (5.5)	AC		76 (3.0)	AC		610 (24.0)	Gravel (GP)	--[3]				Sandy Clay (CL)	11[4]
R3A	Runway 13-31	152 (500)	23 (75)	Very poor	140 (5.5)	AC		76 (3.0)	AC		457 (18.0)	Gravel (GP)	--[3]				Sandy Clay (CL)	9[4]
R4A	Runway 13-31	780 (2,560)	23 (75)	Very poor	140 (5.5)	AC		76 (3.0)	AC		457 (18.0)	Gravel (GP)	--[3]				Sandy Clay (CL)	11[4]
R5A	Runway 13-31	152 (500)	23 (75)	Poor	140 (5.5)	AC		76 (3.0)	AC		457 (18.0)	Gravel (GP)	--[3]				Sandy Clay (CL)	11[4]
R6A	Runway 13-31	152 (400)	23 (75)	Poor	140 (5.5)	AC		76 (3.0)	AC		610 (24.0)	Gravel (GP)	147 (21,281)				Sandy Clay (CL)	117 (17,015)
R7A	Runway 13-31	43 (140)	38 (126)	Excellent				203 (8.0)	PCC	4 (600)	102 (4.0)	Filter Course	199 (28,812)	508 (20.0)	Gravel (GP)	199 (28,812)	Sandy Clay (CL)	107 (15,578)
T1A	Taxiway B	320 (1,050)	15 (50)	Failed	25 (1.0)	AC		25 (1.0)	Bituminous Surface Treatment		229 (9.0)	Gravel (GP)	--[5]				Sandy Clay (CL)	--[5]
T2A	Taxiway C	152 (500)	12 (40)	Excellent				203 (8.0)	PCC	4 (600)	102(4.0)	Filter Course	293 (42,477)	127 (5.0)	Gravel (GP)	293 (42,477)	Sandy Clay (CL)	113 (16,377)
T6A	Taxiway C	72 (237)	12 (40)	Failed	25 (1.0)	AC		51 (2.0)	AC		152 (6.0)	Stabilized Aggregate	46[4]	203 (8.0)	Gravel (GP)	8[4]	Sandy Clay (CL)	8[4]

(Sheet 1 of 3)

[1] Values from original construction data and/or measurements recorded in previous investigations.
[2] Modulus and/or CBR values used for the structural analysis of the pavement features.
[3] Base and subgrade were combined for backcalculating modulus values or for computing CBR values using LOW.
[4] CBR values computed using LOW.
[5] Beyond the lower limit of LOW.

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Table A3 (Continued)

	Facility				Overlay Pavement			Pavement			Base			Subbase			Subgrade	
Feature	Identification	Length m (ft)	Width m (ft)	General Condition PCI	Thickness[1] mm (in.)	Description	Flex. Str.[1] MPa (psi)	Thickness[1] mm (in.)	Description	Flex. Str.[1] MPa (psi)	Thickness[1] Mm (in.)	Description	Modulus[2] MPa (psi)	Thickness[1] mm (in.)	Description	Modulus[2] MPa (psi)	Description	Modulus[2] MPa (psi)
Fixed-Wing Facilities (Continued)																		
T3A	Taxiway D	191 (627)	12 (40)	Fair				229 (9.0)	PCC	4 (600)	102 (4.0)	Filler Course	103 (14,952)				Sandy Clay (CL)	103 (14,952)
T4B	Compass Rose Taxiway	64 (210)	12 (40)	Very poor				51 (2.0)	AC		152 (6.0)	Stabilized Aggregate	64[4]	203 (8.0)	Gravel (GP)	9[4]	Sandy Clay (CL)	9[4]
T5A	Alpha Lane	823 (2,700)	23 (75)	Failed	25 (1.0)	AC		51 (2.0)	AC		152 (6.0)	Stabilized Aggregate	47[4]	203 (8.0)	Gravel (GP-GM)	9[4]	Sandy Clay (CL)	9[4]
A1B	13 Warm-up	99 (325)	46 (150)	Excellent				203 (8.0)	PCC	4 (600)	102 (4.0)	Filter Course	273 (39,586)	127 (5.0)	Gravel (GP)	273 (39,586)	Sandy Clay (CL)	102 (14,742)
A2B	31 Warm-up	119 (390)	58 (190)	Failed	25 (1.0)	AC		51 (2.0)	AC		152 (6.0)	Stabilized Aggregate	26[4]	203 (8.0)	Gravel (GP)	4[4]	Sandy Clay (CL)	4[4]
A3B	Hoverlane	503 (1,650)	46 (150)	Excellent				102 (4.0)	AC		102 (4.0)	Aggregate Base (GW)	36[4]	203 (8.0)	Gravel (GP)	12[4]	Sandy Clay (CL)	12[4]
A4B	Transient Parking Ramp	68 (225)	59 (193)	Very good				178 (7.0)	PCC	4 (600)	102 (4.0)	Filler Course	68 (9,912)				Sandy Clay (CL)	68 (9,912)
A5B	Charlie Parking Ramp	376 (1,235)	33 (110)	Very good				178 (7.0)	PCC	4 (600)	102 (4.0)	Filler Course	74 (10,701)				Sandy Clay (CL)	74 (10,701)
A6B	Charlie Parking Ramp	503 (1,650)	46 (150)	Very good				178 (7.0)	PCC	4 (600)	102 (4.0)	Filler Course	62 (8,981)				Sandy Clay (CL)	62 (8,981)
A7B	Delta Parking Ramp	149 (487)	33 (110)	Very good				178 (7.0)	PCC	4 (600)	102 (4)	Filler Course	72 (10,397)				Sandy Clay (CL)	72 (10,397)

(Sheet 2 of 3)

1 Values from original construction data and/or measurements recorded in previous investigations.
2 Modulus and/or CBR values used for the structural analysis of the pavement features.
3 Base and subgrade were combined for backcalculating modulus values or for computing CBR values using LOW.
4 CBR values computed using LOW.
5 Beyond the lower limit of LOW.

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Table A3 (Concluded)

Facility					Overlay Pavement			Pavement			Base			Subbase			Subgrade	
Feature	Identification	Length m (ft)	Width m (ft)	General Condition PCI	Thickness[1] mm (in.)	Description	Flex. Str.[1] MPa (psi)	Thickness[1] mm (in.)	Description	Flex. Str.[1] MPa (psi)	Thickness[1] Mm (in.)	Description	Modulus[2] MPa (psi)	Thickness[1] mm (in.)	Description	Modulus[2] MPa (psi)	Description	Modulus[2] MPa (psi)
Fixed-Wing Facilities (Continued)																		
A8B	Delta Parking Ramp	149 (487)	33 (110)	Very good				178 (7.0)	PCC	4 (600)	102 (4)	Filler Course	57 (8,226)				Sandy Clay (CL)	57 (8,226)
A9B	Delta Parking Ramp	343 1,125)	69 (225)	Good				229 (9.0)	PCC	4 (600)	102 (4)	Filler Course	98 (14,284)				Sandy Clay (CL)	98 (14,284)
A10B	B East Parking Ramp	148 (487)	33 (110)	Very good				178 (7.0)	PCC	4 (600)	102 (4.0)	Filler Course	67 (9,685)				Sandy Clay (CL)	67 (9,685)
A11B	B West Parking Ramp	148 (487)	33 (110)	Very good				178 (7.0)	PCC	4 (600)	102 (4.0)	Filler Course	62 (8,950)				Sandy Clay (CL)	62 (8,950)
A12B	Compass Rose	30 (100)	30 (100)	Very good				178 (7.0)	PCC	4 (600)	102 (4.0)	Filler Course	63 (9,630)				Sandy Clay (CL)	63 (9,630)
A13B	Alpha Ramp	419 (1,375)	137 (450)	Very good				178 (7.0)	PCC	4 (600)	102 (4.0)	Filler Course	112 (16,218)				Sandy Clay (CL)	112 (16,218)

(Sheet 3 of 3)

[1] Values from original construction data and/or measurements recorded in previous investigations.
[2] Modulus and/or CBR values used for the structural analysis of the pavement features.
[3] Base and subgrade were combined for backcalculating modulus values or for computing CBR values using LOW.
[4] CBR values computed using LOW.
[5] Beyond the lower limit of LOW.

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Appendix B
Tests and Results

Tests Conducted

The pavements were evaluated based on the results from nondestructive testing utilizing a heavy weight deflectometer (HWD). The test procedures and results are discussed below.

Nondestructive Tests

Test equipment

Nondestructive tests (NDT) were performed on the pavements with the Dynatest model 8081 (HWD). The HWD is an impact load device that applies a single-impulse transient load of approximately 25- to 30-millisecond duration. With this trailer-mounted device, a dynamic force is applied to the pavement surface by dropping a weight onto a set of rubber cushions which results in an impulse loading on an underlying circular plate 300 mm (11.8 in.) in diameter in contact with the pavement. The applied force and the pavement deflections, respectively, are measured with load cells and velocity transducers. The drop height of the weights can be varied from 0 to 399 mm (15.7 in.) to produce a force from 0 to approximately 222 kN (50,000 lb). The system is controlled with a laptop computer that also records the output data. Velocities were measured and deflections computed at the center of the load plate (D1) and at distances of 305 (12), 610 (24), 914 (36), 1219 (48), 1524 (60), and 1828 mm (72 in.) (D2 - D7) from the center of the load plate.

Test procedure

On runways and taxiways, deflection basin measurements were made at 30-m (100-ft) intervals on alternate sides of the centerline along the main gear wheel paths. The tests were performed on 3- to 4-m (10- to 12-ft) offsets alternating left and right of the centerline. The parking aprons were tested in a grid pattern of approximately 30-m (100-ft) intervals or at locations that were selected to ensure that adequate NDT were performed per feature for evaluation purposes. Lines along which the NDT were conducted are indicated in Figure B1. At each test location, pavement deflection measurements were recorded at force levels of approximately 67, 122, 157, or 222 kN (15,000, 25,000, 35,000, or 50,000 lb). Impulse stiffness modulus (ISM) values were then calculated based on the slope of the plot of impulse load versus deflection at the first sensor (D1), for the maximum force level.

NDT Analysis

The NDT results or ISM data for each facility were grouped according to different pavement features. Figures B2 through B21 graphically show the ISM test results. A representative basin for each feature was determined using the computerized Layered Elastic Evaluation Program (LEEP). Table B1 shows the representative basins for each feature as determined from the NDT.

Representative basins were used to determine section modulus values of the various layers within the pavement structure in each feature. Deflection basins were input to a multi-layered, linear elastic backcalculation program to determine the surface, base, and subgrade modulus values. The program determines a set of modulus values that provide the best fit between a measured (NDT) deflection basin and a computed (theoretical) deflection basin. Table B2 presents a summary of the backcalculated modulus values based on the representative basins for each pavement section.

Where mean ISM values (as shown in Table B1) were less than 70 MN/m (400 kips/in.), the Low Volume Airfield Pavement Procedure (Bush 1986) computer program (LOW) was used to evaluate the pavements. Twelve features were in this category. ISM and layer thicknesses were input into LOW to determine the equivalent base and subgrade California Bearing Ratio (CBR). Layer thicknesses and respective CBR values were then input into the computer program APE (Computer-Aided Airfield Pavement Evaluation) to compute the load-carrying capacity in terms of PCN of the pavement feature and the overlay thickness requirements. Table B3 shows the CBR values determined from LOW.

Modulus values for AC surface layers can be determined using three methods: (a) use the surface temperature at the time of testing and the previous 5-day mean air temperature, (b) backcalculate the modulus values using the HWD deflection basins, or (c) determine the design modulus from past temperature data. All three methods of determining the AC modulus values are described in UFC 3-260-03 (Headquarters, Departments of the Army, the Air Force, and the Navy April 2001a). All pavements have been evaluated for a design life of 20 years. The modulus of an AC layer is temperature dependent; therefore, seasonal variation is considered by using a design modulus based on historical temperature data. From the climatological table (Table A1), an average daily maximum temperature of 27ºC (80ºF) and an average daily mean of 21ºC (69ºF) for June (hottest month) were used in determining the design AC modulus. For a loading frequency of 2 Hz for taxiways and aprons, the design AC modulus is 885 MPa (128,337 psi) for a loading frequency of 10 Hz for the runway, the design AC modulus is 1556 MPa (225,719 psi). The design AC modulus along with the backcalculated values for the base and subgrade layers were used to determine the structural capacity of the AC pavement features.

Modulus values for PCC pavements can be backcalculated using the HWD deflection basins or a design modulus for the PCC can be used. In the evaluation of a rigid pavement, the design modulus should be used for the PCC layer along with the backcalculated values for the subgrade layers. The backcalculated PCC modulus values shown in Table B2 for features T2A, A1B, and A12B are greater than the default range of 17 237 to 68 947 MPa (2,500,000 to 10,000,000 psi) recommended in UFC 3-260-03 (Headquarters, Departments of the Army, Navy, and the Air Force, and the Navy 2001a). This manual also recommends a modulus of 34 474 MPa (5,000,000 psi) for a PCC layer in good condition.

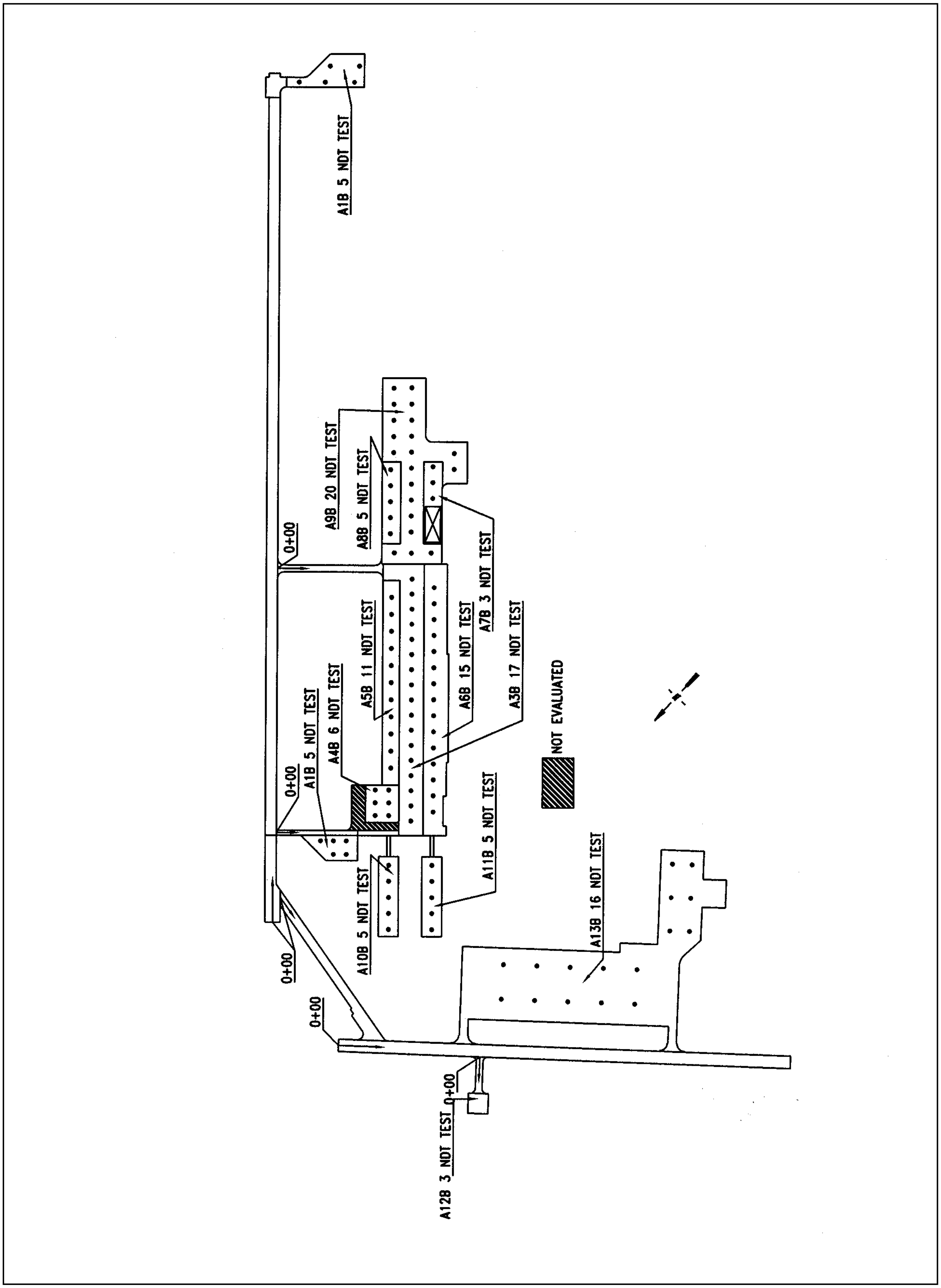

Figure B1. NDT test locations/direction

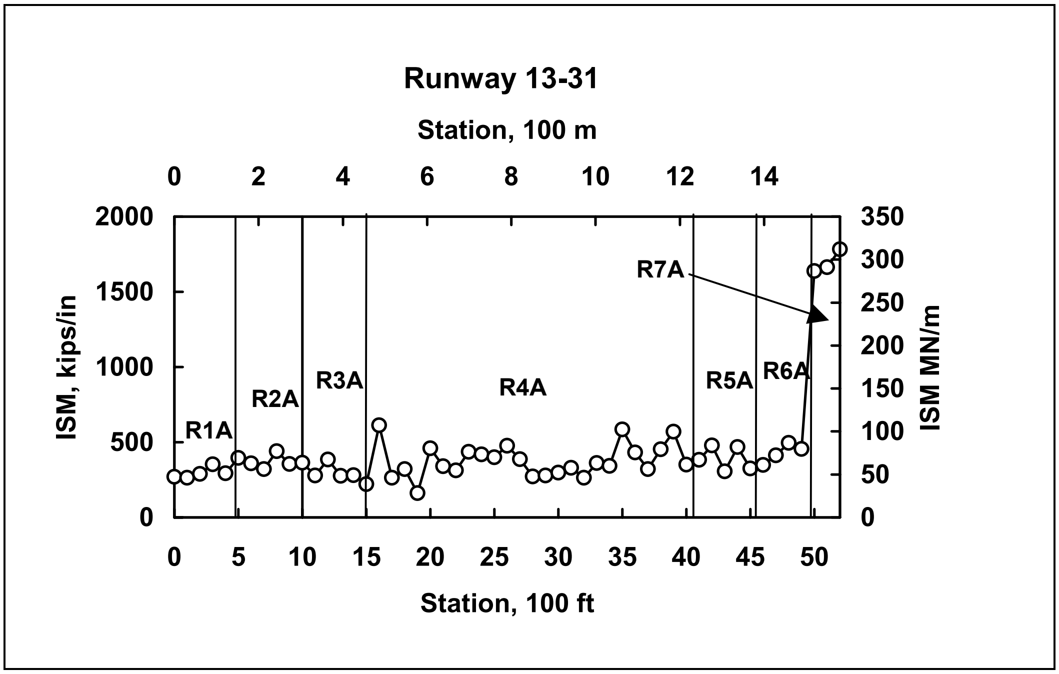

Figure B2. ISM profile, Runway 13-31, Features R1A thru R7A

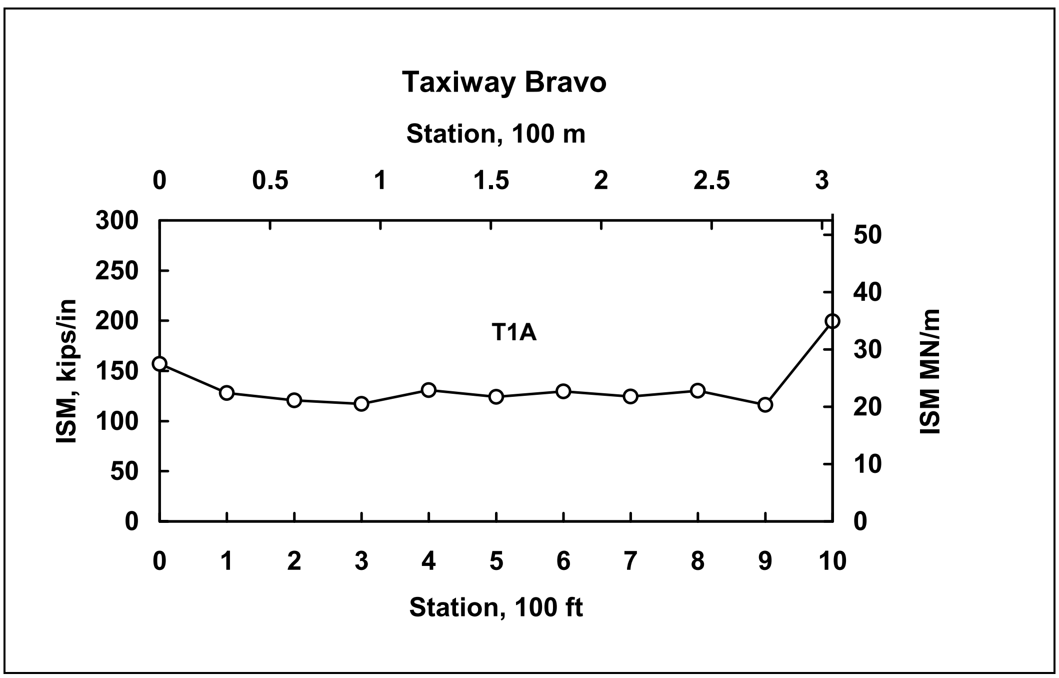

Figure B3. ISM profile, Taxiway Bravo, Feature T1A

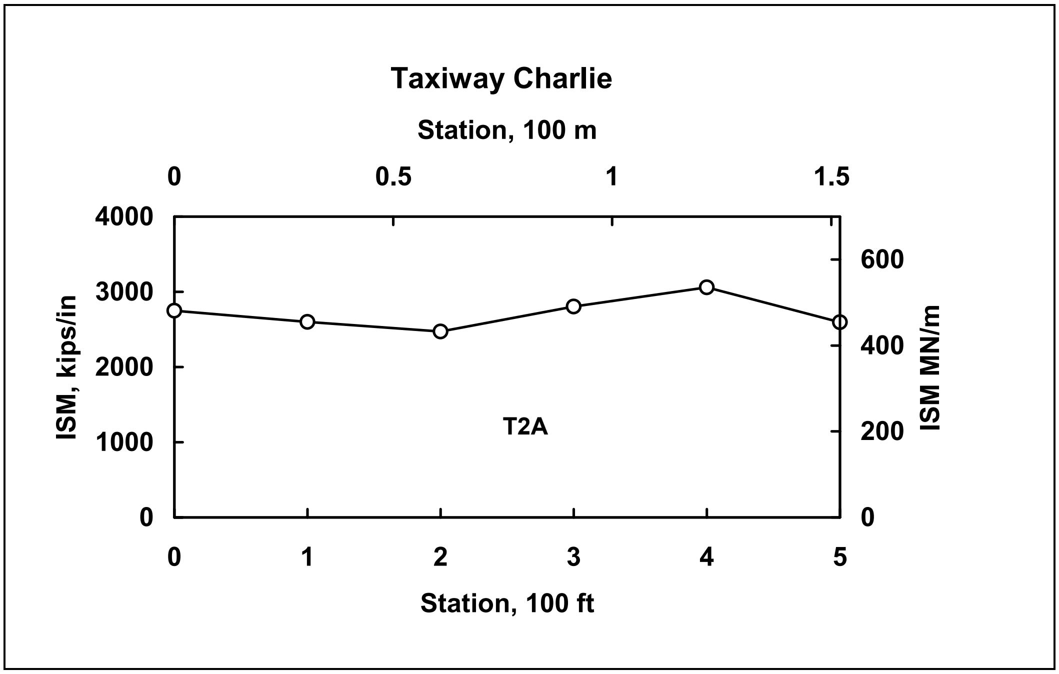

Figure B4. ISM profile, Taxiway Charlie, Feature T2A

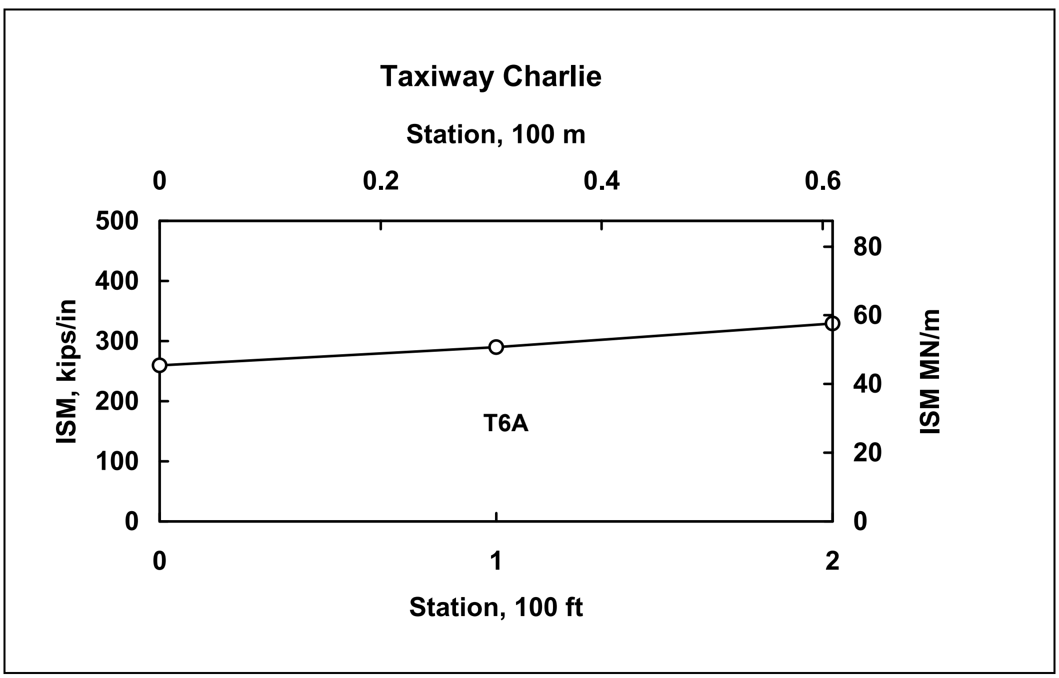

Figure B5. ISM profile, Taxiway Charlie, Feature T6A

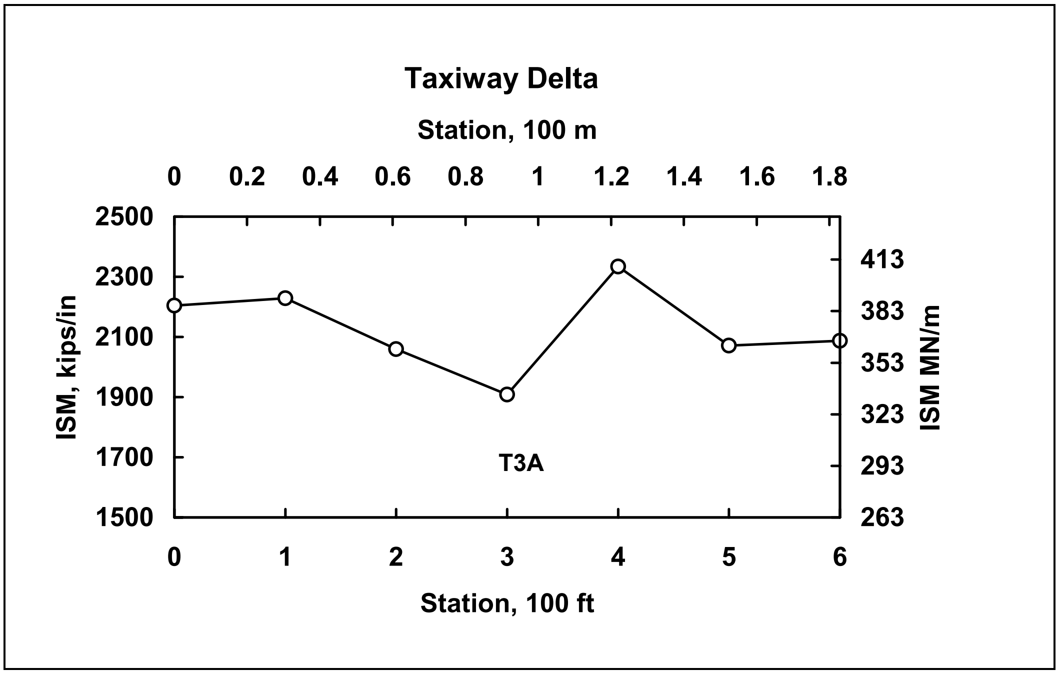

Figure B6. ISM profile, Taxiway Delta, Feature T3A

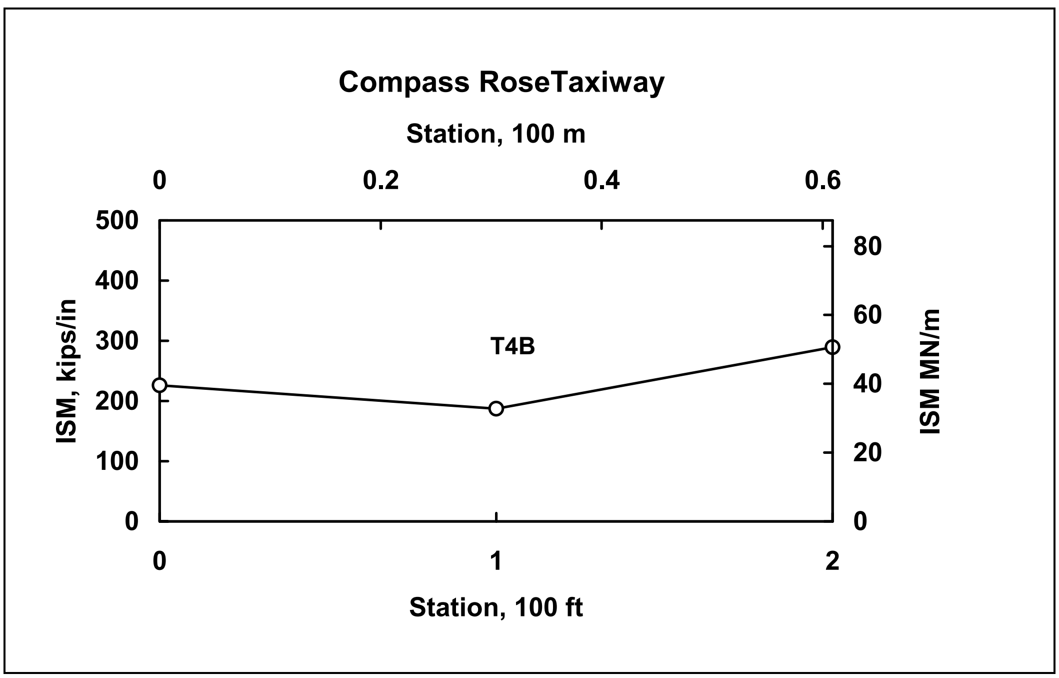

Figure B7. ISM profile, Compass Rose Taxiway, Feature T4B

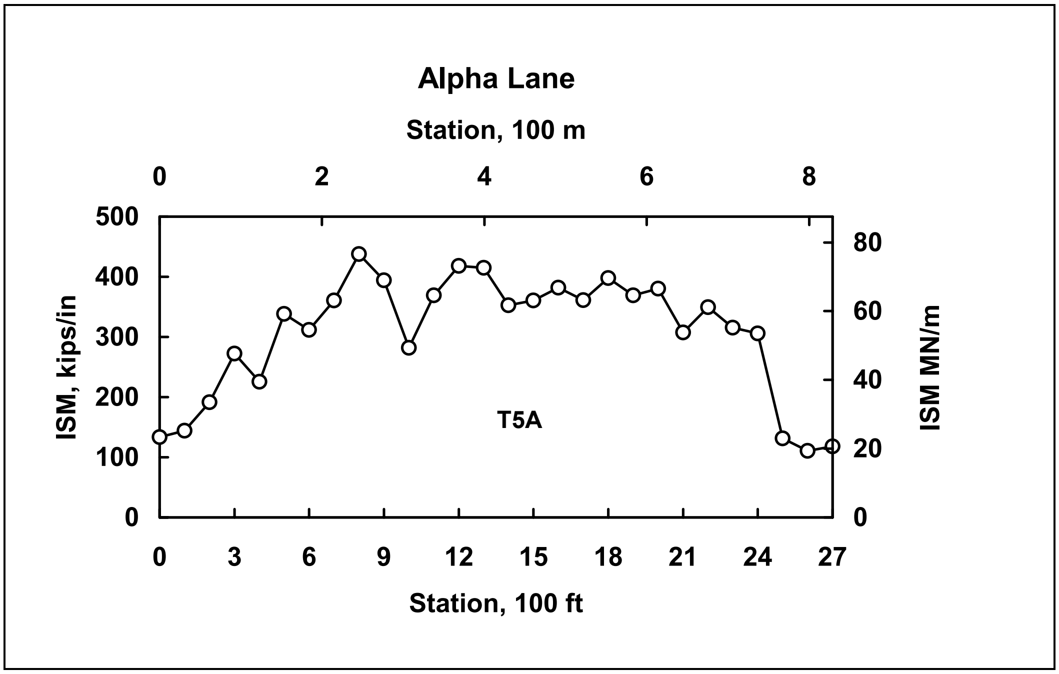

Figure B8. ISM profile, Alpha Lane, Features T5A

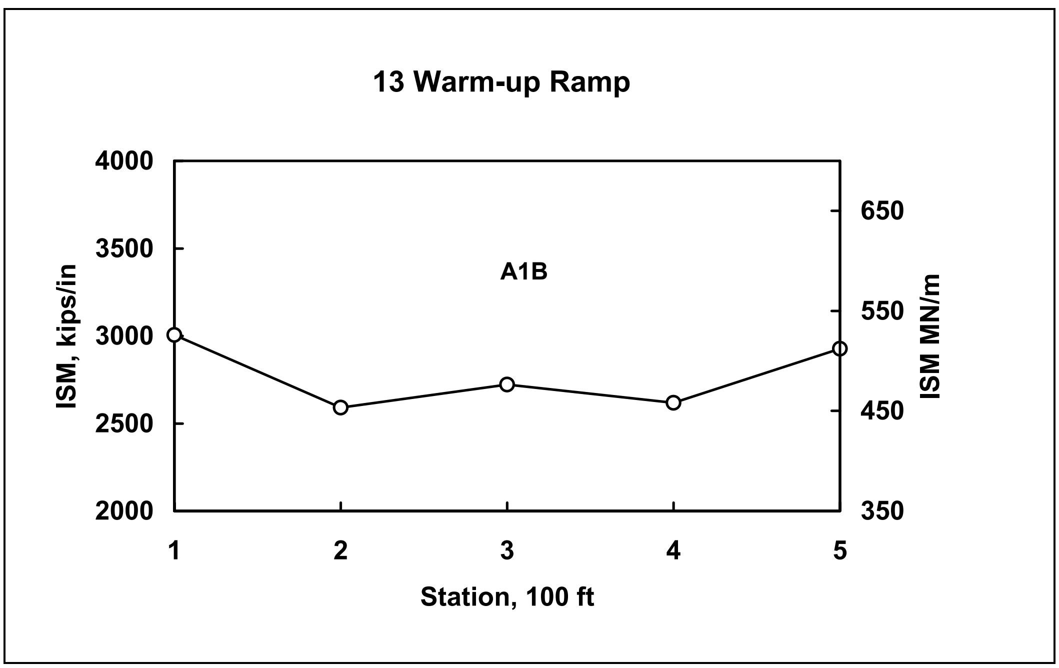

Figure B9. ISM profile, 13 Warm-up Ramp, Feature A1B

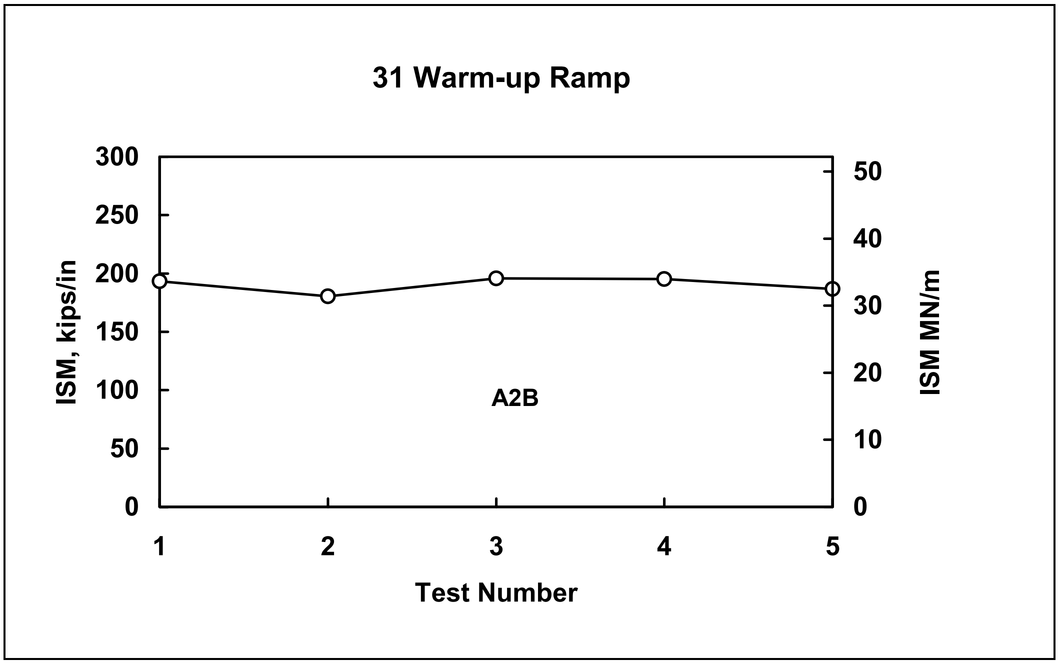

Figure B10. ISM profile, 31 Warm-up Ramp, Feature A2B

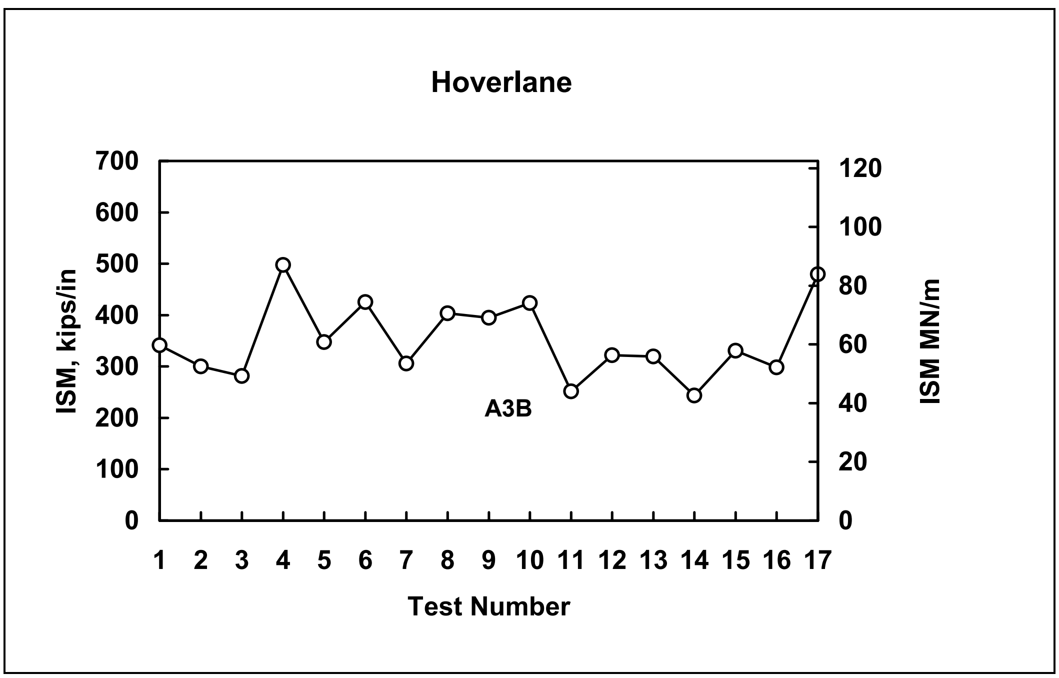

Figure B11. ISM profile, Hoverlane, Feature A3B

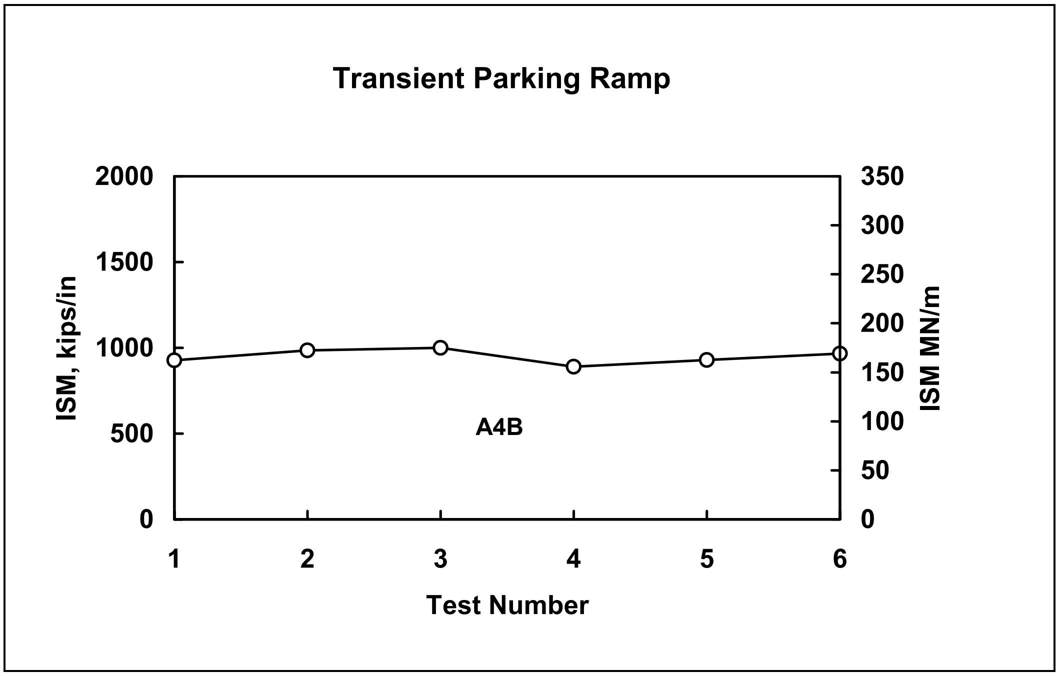

Figure B12. ISM profile, Transient Parking Ramp, Feature A4B

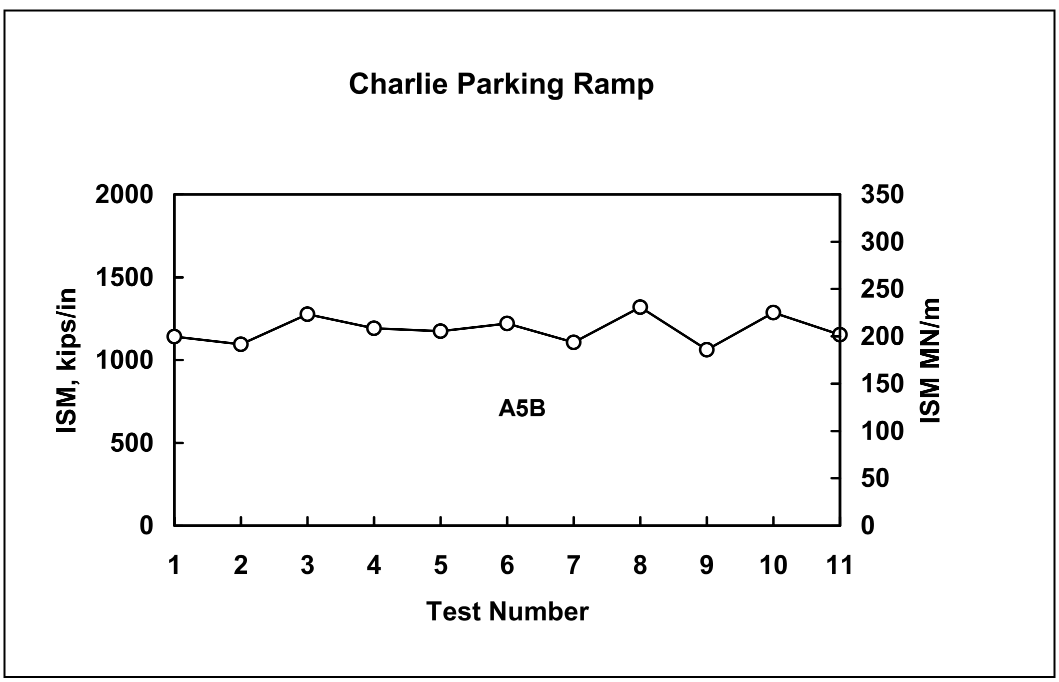

Figure B13. ISM profile, Charlie Parking Ramp, Feature A5B

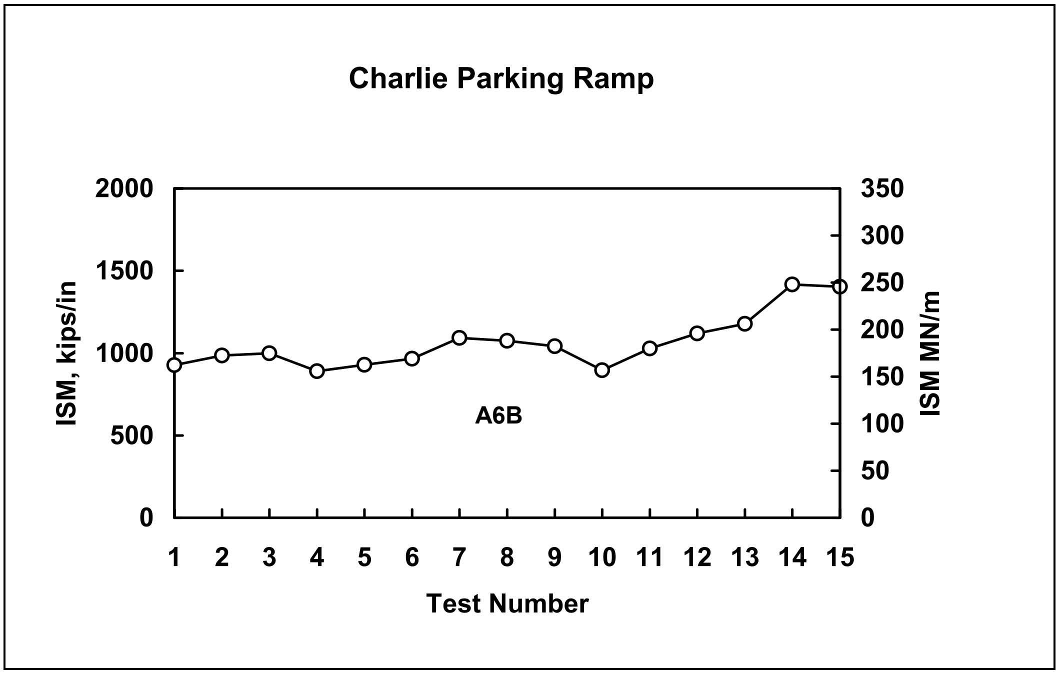

Figure B14. ISM profile, Charlie Parking Ramp, Feature A6B

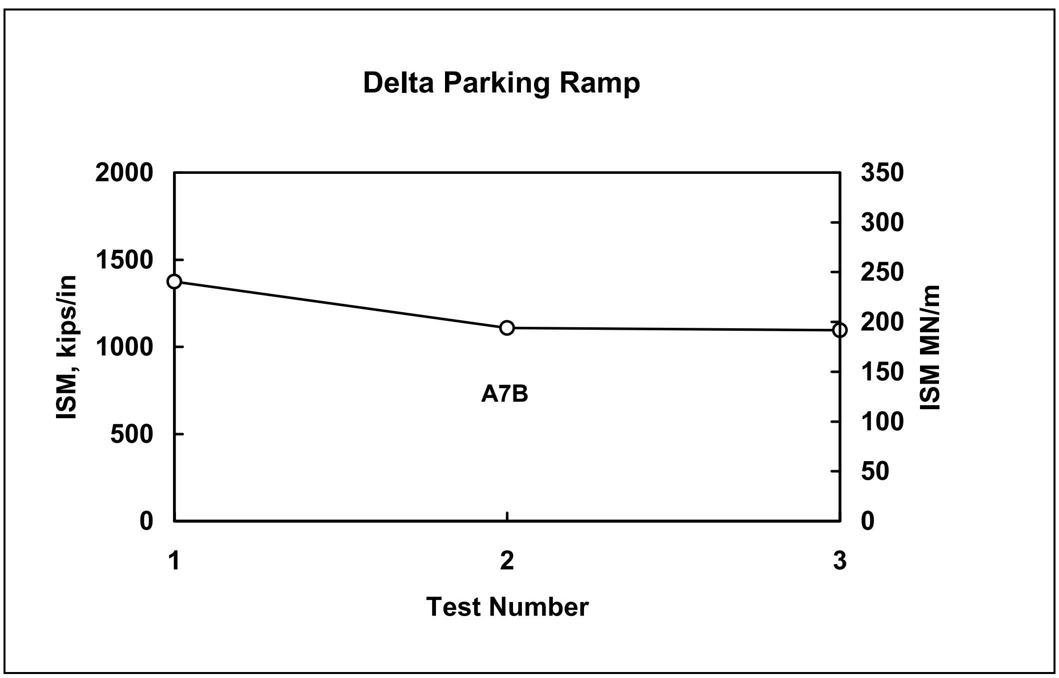

Figure B15. ISM profile, Delta Parking Ramp, Feature A7B

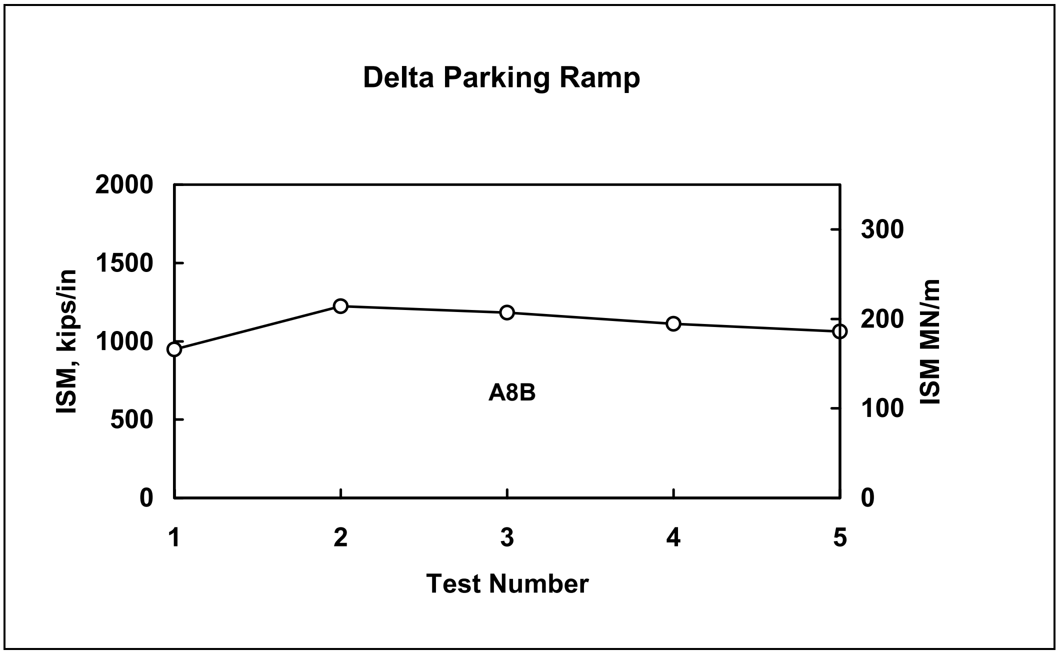

Figure B16. ISM profile, Delta Parking Ramp, Feature A8B

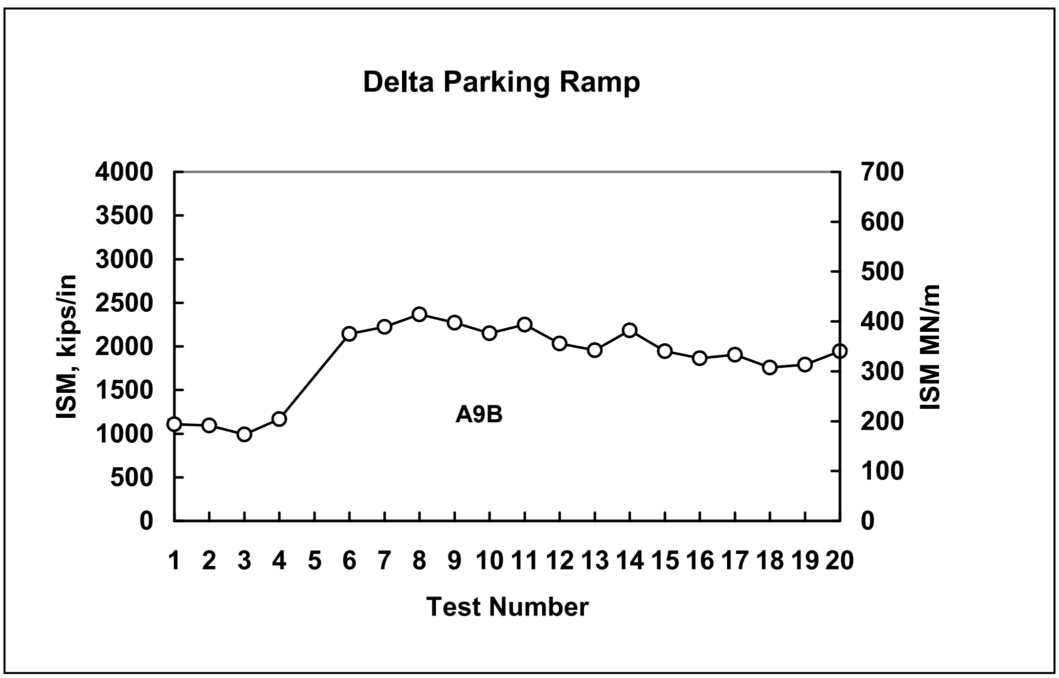

Figure B17. ISM profile, Delta Parking Ramp, Feature A9B

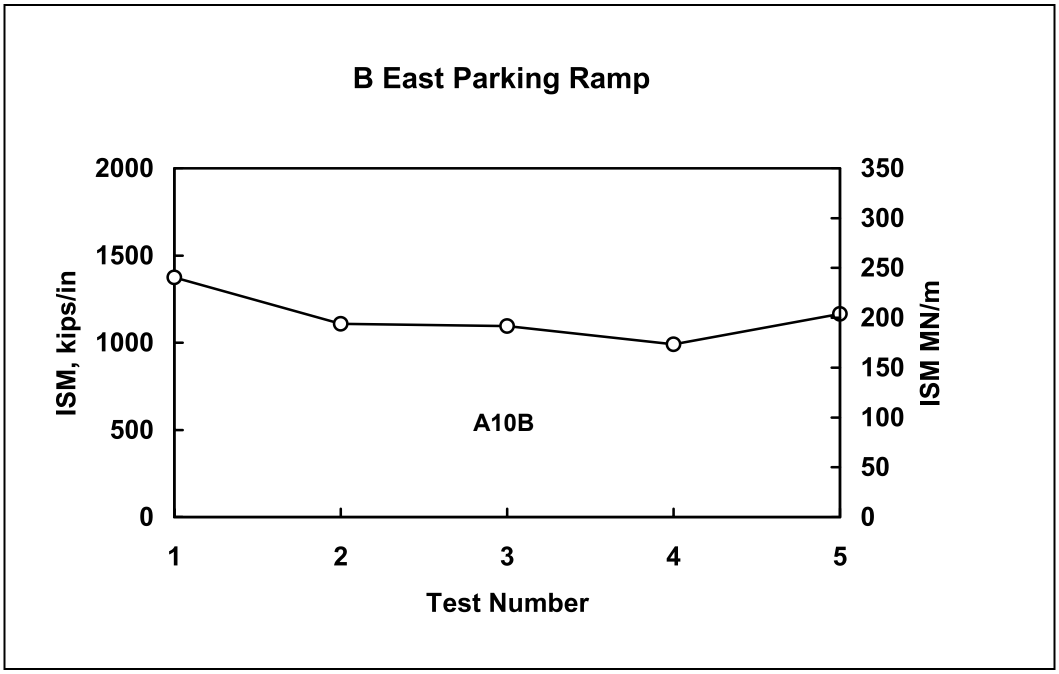

Figure B18. ISM profile, b East Parking Ramp, Feature A10B

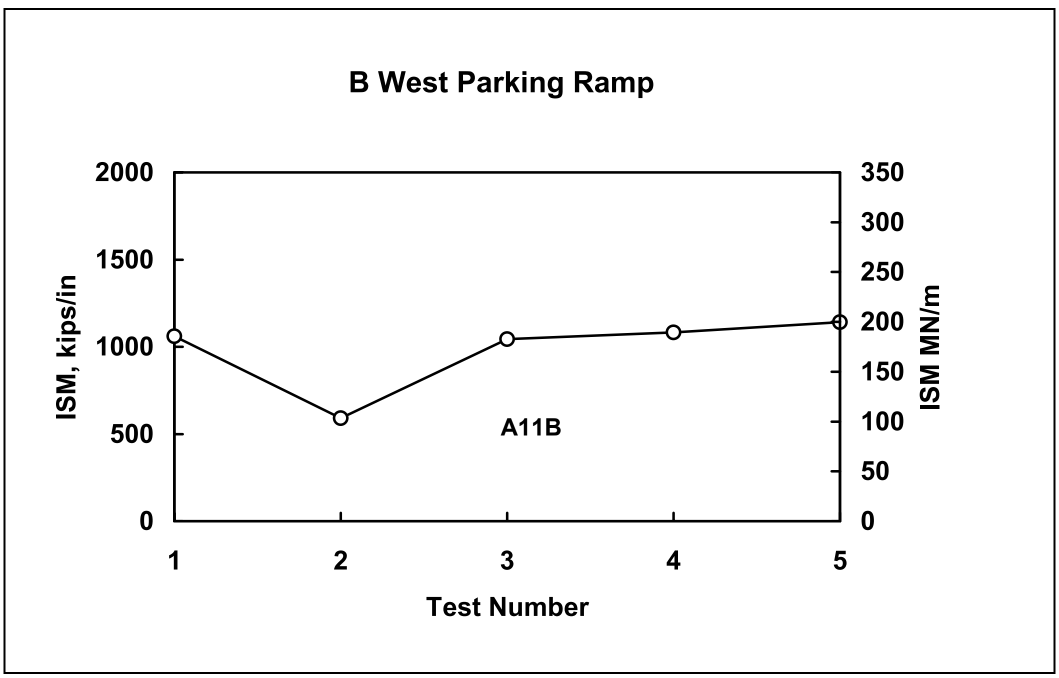

Figure B19. ISM profile, B West Parking Ramp, Feature A11B

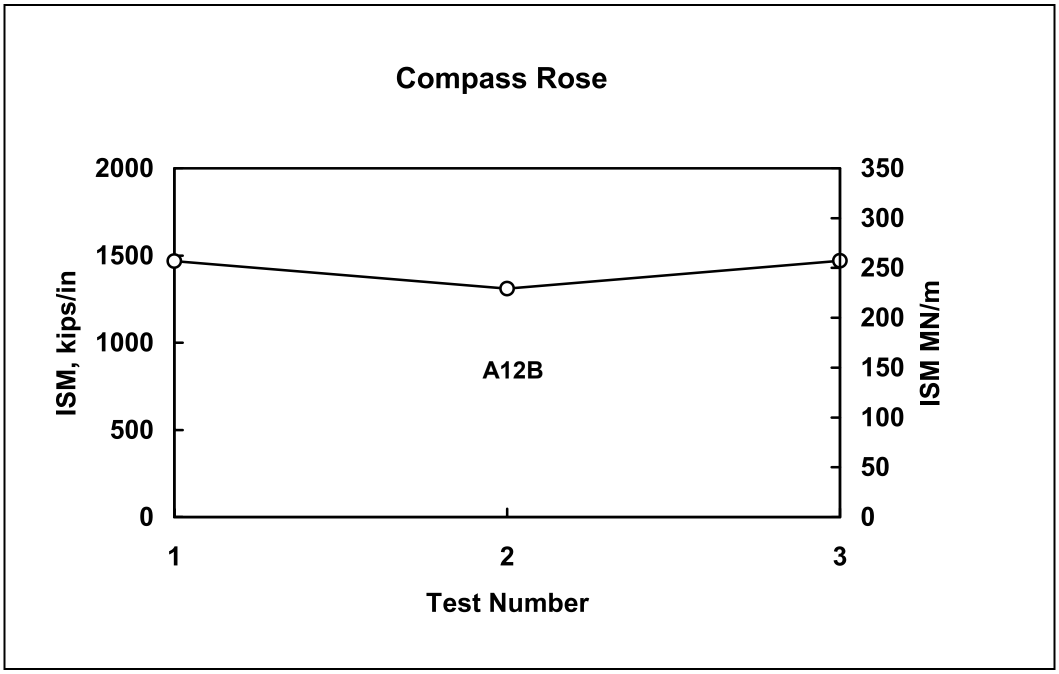

Figure B20. ISM profile, Compass Rose, Feature A12B

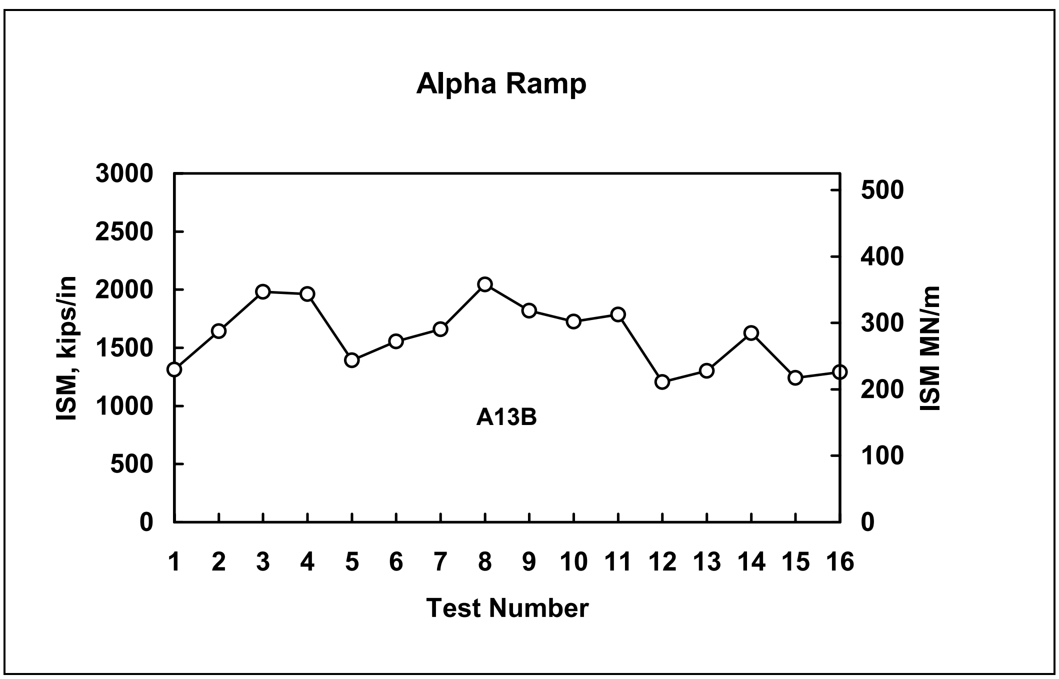

Figure B21. ISM profile, Alpha Ramp, Feature A13B

Table B1
NDT Test Results, Representative Basins

Feature	ISM MN/m (kips/in.)	Load kN (lb)	Deflection, μm (mils) D1	D2	D3	D4	D5	D6	D7
Runway 13-31									
R1A	51 (289)	90 (20,141)	1773 (69.8)	950 (37.4)	462 (18.2)	290 (11.4)	208 (8.2)	157 (6.2)	124 (4.9)
R2A	63 (360)	89 (20,093)	1422 (56.0)	826 (32.5)	457 (18.0)	282 (11.1)	193 (7.6)	147 (5.8)	117 (4.6)
R3A	68 (386)	93 (20,463)	1346 (53.0)	909 (35.8)	574 (22.6)	363 (14.3)	244 (9.6)	168 (6.6)	137 (5.4)
R4A	61 (350)	93 (20,490)	1483 (58.4)	808 (31.8)	414 (16.3)	244 (9.6)	168 (6.6)	127 (5.0)	102 (4.0)
R5A	67 (382)	96 (21,090)	1400 (55.1)	734 (28.9)	381 (15.0)	216 (8.5)	150 (5.9)	112 (4.4)	86 (3.4)
R6A	73 (414)	95 (21,388)	1313 (51.7)	602 (23.7)	302 (11.9)	185 (7.3)	130 (5.1)	102 (4.0)	84 (3.3)
R7A	292 (1,668)	96 (21,511)	328 (12.9)	302 (11.9)	254 (10.0)	203 (8.0)	157 (6.2)	114 (4.5)	81 (3.2)
Taxiway Bravo									
T1A	22 (128)	54 (12,049)	2393 (94.2)	1069 (42.1)	455 (17.9)	259 (10.2)	229 (6.9)	127 (5.0)	97 (3.8)
Taxiway Charlie									
T2A	482 (2,751)	229 (51,436)	475 (18.7)	439 (17.3)	394 (15.5)	351 (13.8)	310 (12.2)	269 (10.6)	229 (9.0)
T6A	46 (260)	63 (14,210)	1389 (54.7)	835 (32.9)	442 (17.4)	269 (10.6)	183 (7.2)	137 (5.4)	102 (4.0)
Taxiway Delta									
T3A	365 (2,083)	220 (49,581)	605 (23.8)	559 (22.0)	493 (19.4)	422 (16.6)	351 (13.8)	284 (11.2)	229 (9.0)
Compass Rose Taxiway									
T4B	40 (226)	65 (14,659)	1646 (64.8)	879 (34.6)	401 (15.8)	234 (9.2)	170 (6.7)	132 (5.2)	107 (4.2)
Alpha Lane									
T5A	53 (305)	64 (14,476)	1204 (47.4)	663 (26.1)	330 (13.0)	206 (8.1)	147 (5.8)	114 (4.5)	102 (3.5)
13 Warm-up Ramp									
A1B	476 (2,717)	230 (51,627)	483 (19.0)	450 (17.7)	406 (16.0)	361 (14.2)	315 (12.4)	267 (10.5)	224 (8.8)
31 Warm-up Ramp									
A2B	32 (180)	64 (14,317)	2017 (79.4)	953 (37.5)	414 (16.3)	127 (9.3)	152 (6.0)	122 (4.8)	97 (3.8)
Hoverlane									
A3B	61 (348)	60 (13,598)	993 (39.1)	587 (23.1)	302 (11.9)	185 (7.3)	127 (5.0)	178 (3.7)	76 (3.0)
Transient Parking Ramp									
A4B	178 (1,019)	219 (49,323)	1229 (48.4)	1097 (43.2)	932 (36.7)	765 (30.1)	612 (24.1)	462 (18.2)	325 (12.8)
Charlie Parking Ramp									
A5B	214 (1,221)	218 (49,104)	1021 (40.2)	950 (37.4)	826 (32.5)	691 (27.2)	551 (21.7)	419 (16.5)	302 (11.9)
A6B	121 (1,073)	216 (48,505)	1148 (45.2)	1057 (41.6)	914 (36.0)	767 (30.2)	620 (24.4)	488 (19.2)	363 (14.3)

(Continued)

Table B1 (Concluded)									
	ISM	Load	Deflection, µm (mils)						
Feature	MN/m (kips/in.)	kN (lb)	D1	D2	D3	D4	D5	D6	D7
Delta Parking Ramp									
A7B	241 (1,376)	215 (48,282)	892 (35.1)	950 (37.4)	815 (32.1)	673 (26.5)	538 (21.2)	414 (16.3)	305 (12.0)
A8B	207 (1,184)	213 (47,833)	1026 (40.4)	1184 (46.6)	1024 (40.3)	853 (33.6)	676 (26.6)	511 (20.1)	361 (14.2)
A9B	355 (2,026)	219 (49,228)	490 (24.3)	457 (22.4)	307 (19.5)	218 (16.7)	150 (14.0)	99 (11.6)	56 (9.5)
B East Parking Ramp									
A10B	194 (1,108)	212 (47,774)	1095 (43.1)	1022 (40.2)	881 (34.7)	714 (28.1)	587 (23.1)	452 (17.8)	328 (12.9)
B West Parking Ramp									
A11B	184 (1,050)	211 (47,460)	1148 (45.2)	1054 (41.5)	919 (36.2)	772 (30.4)	625 (24.6)	483 (19.0)	356 (14.0)
Compass Rose									
A12B	257 (1,468)	223 (50,042)	866 (34.1)	803 (31.6)	714 (28.1)	622 (24.5)	528 (20.8)	442 (17.4)	361 (14.2)
Alpha Ramp									
A13B	302 (1,724)	221 (49,661)	732 (28.8)	655 (25.8)	554 (21.8)	457 (18.0)	366 (14.4)	284 (11.2)	213 (8.4)

Table B2
Summary of Modulus Values[1]

Feature	Surface Modulus MPa (psi[1])	Base Modulus MPa (psi)[1]	Subbase Modulus MPa (psi)[1]	Subgrade Modulus MPa (psi)[1]
PCC Pavements				
R7A	25 531 (3,702,975)	199 (28,812)[2]	--	107 (15,578)
T2A	103 421 (15,000,000)	293 (42,477)[2]	--	113 (16,377)
T3A	49 990 (7,105,409)	--	--	103 (14,952)
A1B	127 888 (18,549,542)	273 (39,586)[2]	--	102 (14,742)
A4B	31 139 (4,516,324)	--	--	68 (9,912)
A5B	41 618 (6,036,187)	--	--	74 (10,701)
A6B	35 968 (5,216,678)	--	--	62 (8,981)
A7B	49 732 (7,212,975)	--	--	72 (10,397)
A8B	42 929 (6,226,351)	--	--	57 (8,226)
A9B	50 063 (7,261,050)	--	--	98 (14,284)
A10B	38 082 (5,523,290)	--	--	67 (9,685)
A11B	38 411 (5,571,095)	--	--	62 (8,950)
A12B	80 226 (11,635,792)	--	--	66 (9,630)
A13B	57 670 (8,364,400)	--	--	111 (16,218)
AC Pavements[3]				
R1A[5]	1953 (283,194)	111 (16,154)[2]	--	72 (10,406)[2]
R2A[5]	607 (88,079)	94 (13,620)	--	75 (10,899)
R3A[5]	261 (37,833)	207 (30,000)	--	51 (7,341)
R4A[5]	589 (124,571)	112 (16,180)	--	74 (10,744)
R5A[5]	555 (80,454)	105 (15166)	--	103 (14,953)
R6A	474 (68,680)	147 (21,281)	--	117 (17,015)
T1A[5]	7822 (1,134,507)	377 (54,726)	--	64 (9,350)
T4B[5]	8317 (1,206,289)	160 (23,267)	58 (8,386)[4]	58 (8,386)[4]
T5B[5]	3402 (493,447)	122 (17,694)	75 (10,949)[4]	75 (10,949)[4]

(Continued)

[1] Backcalculated modulus values using WESDEF.
[2] Filter or base course and subbase were combined.
[3] AC modulus based on temperature at the time of testing.
[4] Based or subbase and subgrade combined.
[5] ISM was < 400; therefore, LOW was used to compute base and subgrade CBR.

Table B2 (Concluded)				
Feature	**Surface Modulus MPa (psi[1])**	**Base Modulus MPa (psi)[1]**	**Subbase Modulus MPa (psi)[1]**	**Subgrade Modulus MPa (psi)[1]**
AC Pavements				
T6A [5]	2219 (321,843)	162 (23,524)	59 (8,510) [4]	59 (8,510) [4]
A2B [5]	302 (43,821)	164 (23,756)	59 (8,624) [4]	59 (8,624) [4]
A3B [5]	1095 (158,786)	206 (30,000) [2]	206 (30,000) [2]	75 (10,872)

[1] Backcalculated modulus values using WESDEF.
[2] Filter or base course and subbase were combined.
[3] AC modulus based on temperature at the time of testing.
[4] Based or subbase and subgrade combined.
[5] ISM was < 400; therefore, LOW was used to compute base and subgrade CBR.

Table B3
Summary of CBR Values Determined from LOW

Feature	Mean ISM MN/m (kips/in.)	Pavement Age, Years	Surface Thickness mm (in.)	Base Thickness mm (in.)	Subbase Thickness mm (in.)	Base CBR, %	Subbase CBR, %	Subgrade CBR, %
R1A	51 (289)	2	102 (4.0)	178 (7.0)		34		6
R2A	63 (360)	16	216 (8.5)					11
R3A	68 (386)	16	216 (8.5)					9
R4A	61 (350)	16	216 (8.5)					11
R5A	67 (382)	16	216 (8.5)					11
R6A	72 (414)	16	216 (8.5)					11
T1A	22 (128)	29	51 (2.0)	229 (9.0)		--[1]		--[1]
T4B	40 (226)	38	51 (2.0)	152 (6.0)		64		9
T5A	53 (305)	29	76 (3.0)	152 (6.0)		47		9
T6A	46 (260)	29	76 (3.0)	152 (6.0)		46		8
A2B	32 (180)	29	76 (3.0)	152 (6.0)		26		4
A3B	61 (348)	2	102 (4.0)	102 (4.0)		36		12

[1] Beyond the lower limit of LOW.

Appendix C
Pavement Condition Survey and Results

Pavement Condition Survey

A pavement condition survey is a visual inspection of the airfield pavements to determine the present surface condition. The condition survey consists of inspecting the pavement surface for various types of distress, determining the severity of each distress, and measuring the quantity of each distress. The estimated quantities and severity of each distress type are used to compute the PCI for each feature. The PCI is a numerical indicator based on a scale from 0 to 100 and is determined by measuring pavement surface distress that reflects the surface condition of the pavement. Pavement condition ratings (from excellent to failed) are assigned to different levels of PCI values. These ratings and their respective PCI value definitions are shown in Figure C1. The distress types, severity levels, methods of survey, and PCI calculations are described in ASTM D5340-93.

The PCI and estimated distress quantities are determined for each feature. The information is based on inspection of a selected number of sample units. Sample units are subdivisions of a feature used exclusively to facilitate the inspection process and reduce the effort needed to determine distress quantities and the PCI. Each feature was divided into sample units. The sample units for AC pavement features were approximately 465 sq m (5,000 sq ft). A statistical sampling technique was used to determine the number of sample units to be inspected to provide a 95 percent confidence level. Sample units were chosen along the centerline of the runway and taxiways and randomly on the aprons. The stationing and direction of survey are shown in Figure B1. Sample unit locations for the runway feature R7A is shown in Figure C2. Sample unit locations for the PCC taxiway features T2A and T3A are shown in Figure C3. Sample unit locations for the apron/ramp areas are shown in Figures C4-C11. The surveyed sample units are circled. After the sample units were inspected, the mean PCI of all sample units within a feature was calculated and the feature was rated as to its condition: excellent, very good, good, fair, poor, very poor, or failed.

Analysis of PCI Data

The distress information collected during the survey was used with the Micro PAVER computer program to estimate the quantities of distress types for each feature. This information is presented along with the PCI, general rating, and distress mechanism (load, climate, or other) in Appendix E. Photos C1 through C10 show various types of distresses observed during the survey.

AR 420-72 (Headquarters, Department of the Army 2000) requires that all airfield pavements be maintained at or above the following PCI ranges:

All runways > 70
All primary taxiways ≥ 60
All aprons and secondary taxiways > 55

AR 420-72 (Headquarters, Department of the Army 2000) also requires that the following PCI range for airfield pavements shall be used for the Installation Status Report (ISR) rating:

70 < PCI ≤ 100 equals an ISR Green rating
55 < PCI ≤ 70 equals an ISR Amber rating
0 < PCI ≤ 55 equals an ISR Red rating

The PCI for each sample unit inspected was calculated and stored on a Micro PAVER file for BAAF. The mean PCI for each feature was then calculated to determine the general condition or rating of the feature as shown in Figure C12. A comparison of the 2002, 1995, and 1993 PCI results is summarized in Table C1. The PCI of five runway features decreased from twenty-six to thirty-five points during the 1995 to 2002 period. This loss in PCI points for each feature (R2A-R6A) is due to additional and/or more severe alligator cracking, block cracking, linear cracking, and rutting. The PCI of R1A increased by eighty-nine points due to surface reconstruction. The PCI of all but one of the taxiway features remained about the same during the 1995 to 2002 period. One taxiway feature (T2A) had an increase in PCI of eighty-seven points, which was attributed to reconstruction in 2001. The PCI of all but two of the apron/ramp features remained about the same during the 1995 to 2002 period. Features A1B and A3B had an increase in PCI of eighty-seven and eighty-nine points, respectively. These increases are attributed to reconstruction in 2001.

PAVEMENT CONDITION INDEX (PCI)	PAVEMENT CONDITION RATING
100 86	EXCELLENT
85 71	VERY GOOD
70 56	GOOD
55 41	FAIR
40 26	POOR
25 11	VERY POOR
10 0	FAILED

Figure C1. Scale for pavement condition rating

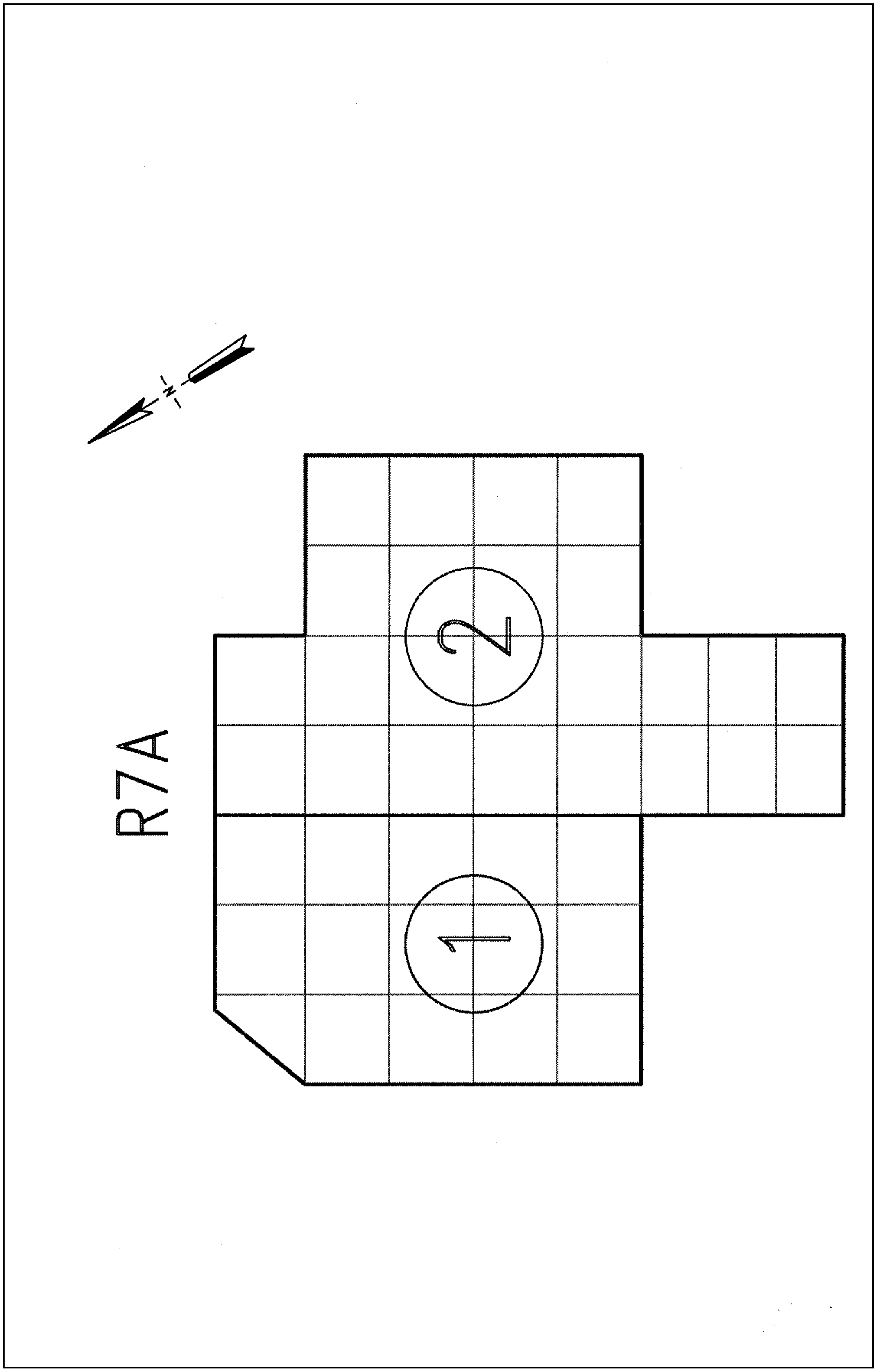

Figure C2. Sample unit layout, Runway 13-31, feature R7A

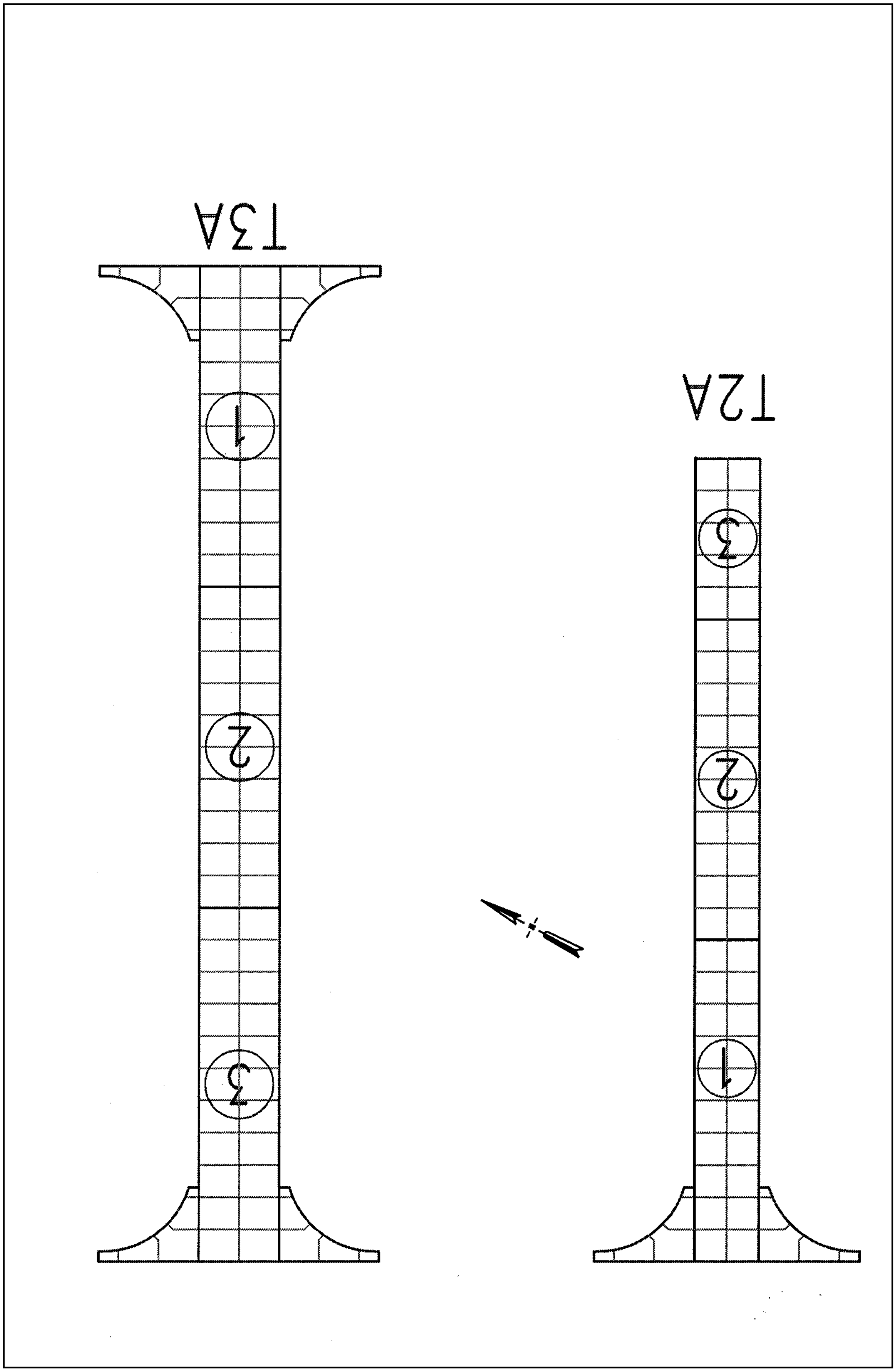

Figure C3. Sample unit layout, Taxiways Charlie and Delta, features T2A and T3A

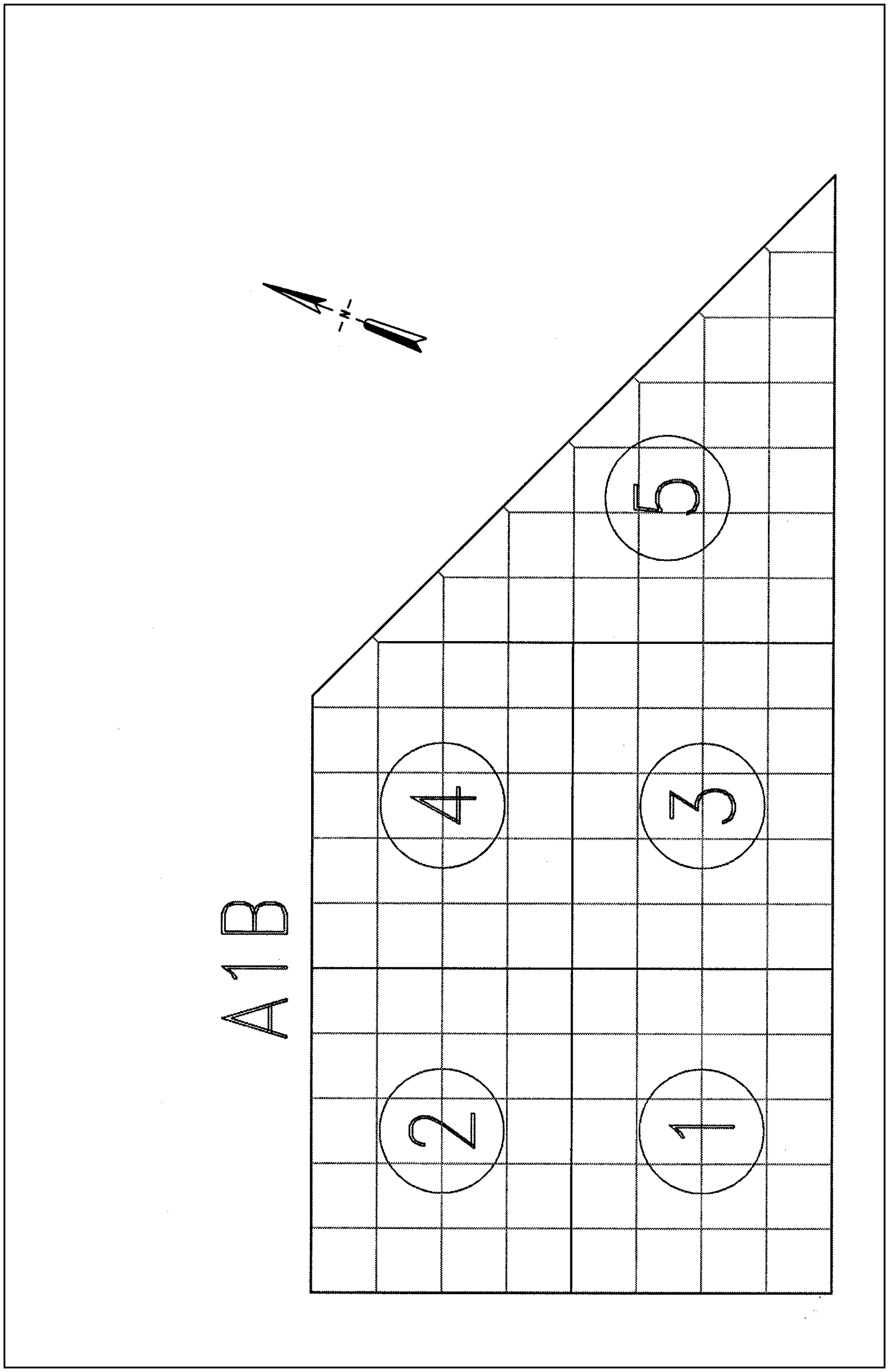

Figure C4. Sample unit layout, 13 Warm-up Ramp, feature A1B

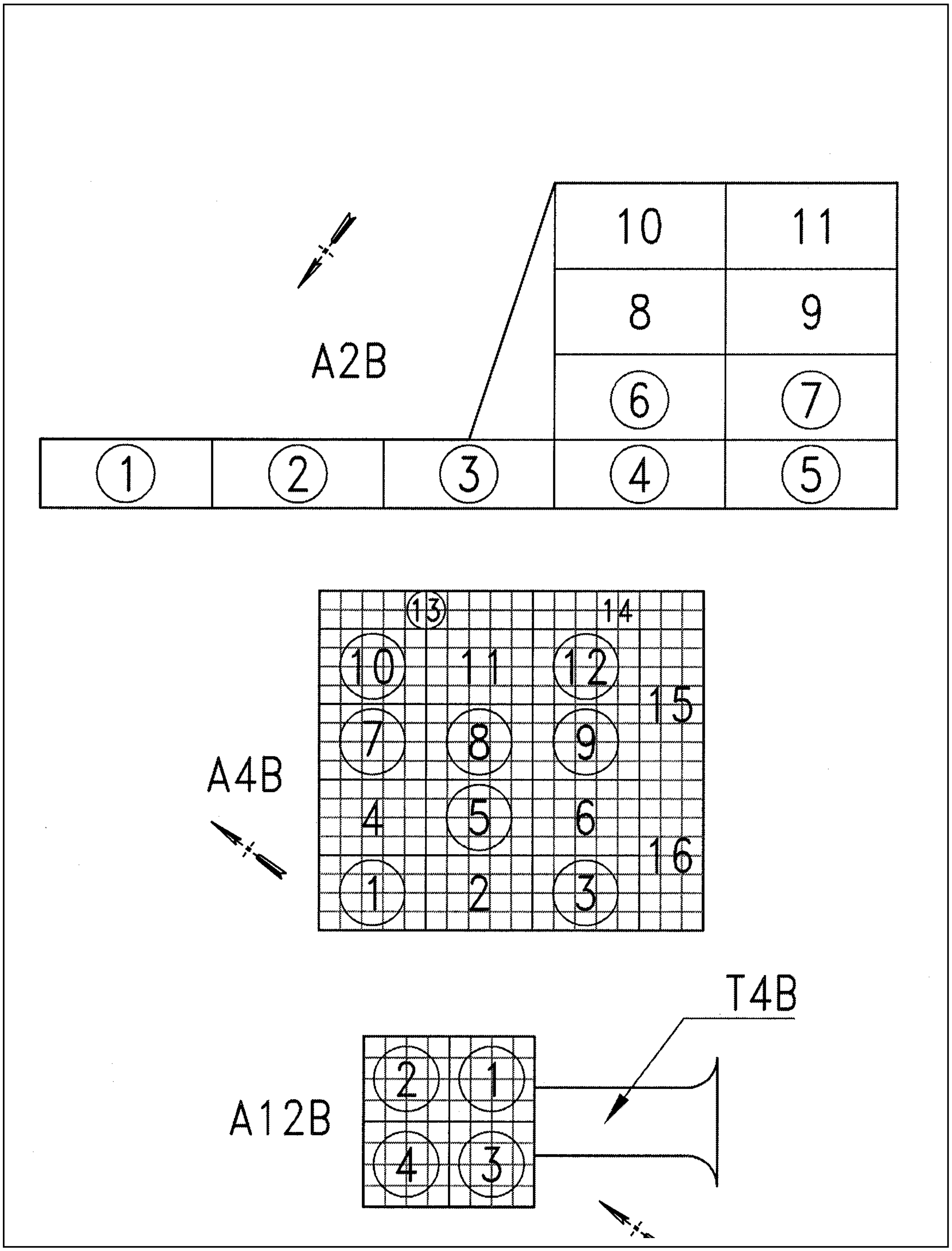

Figure C5. Sample unit layout, 31 Warm-up Ramp, Transient Parking Ramp, and the Compass Rose, features A2B, A4B, and A12B, respectively

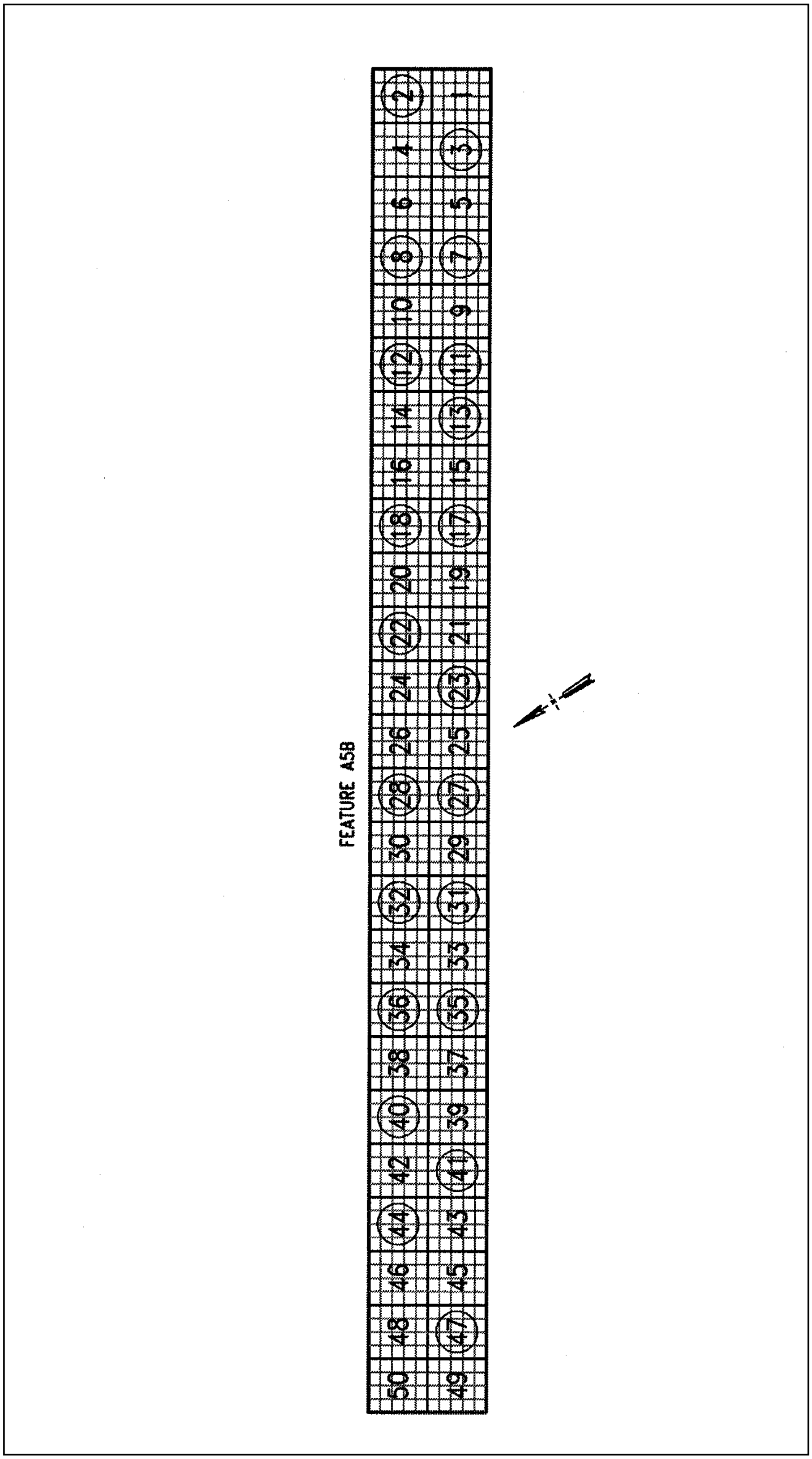

Figure C6. Sample unit layout, Charlie Parking Ramp, feature A5B

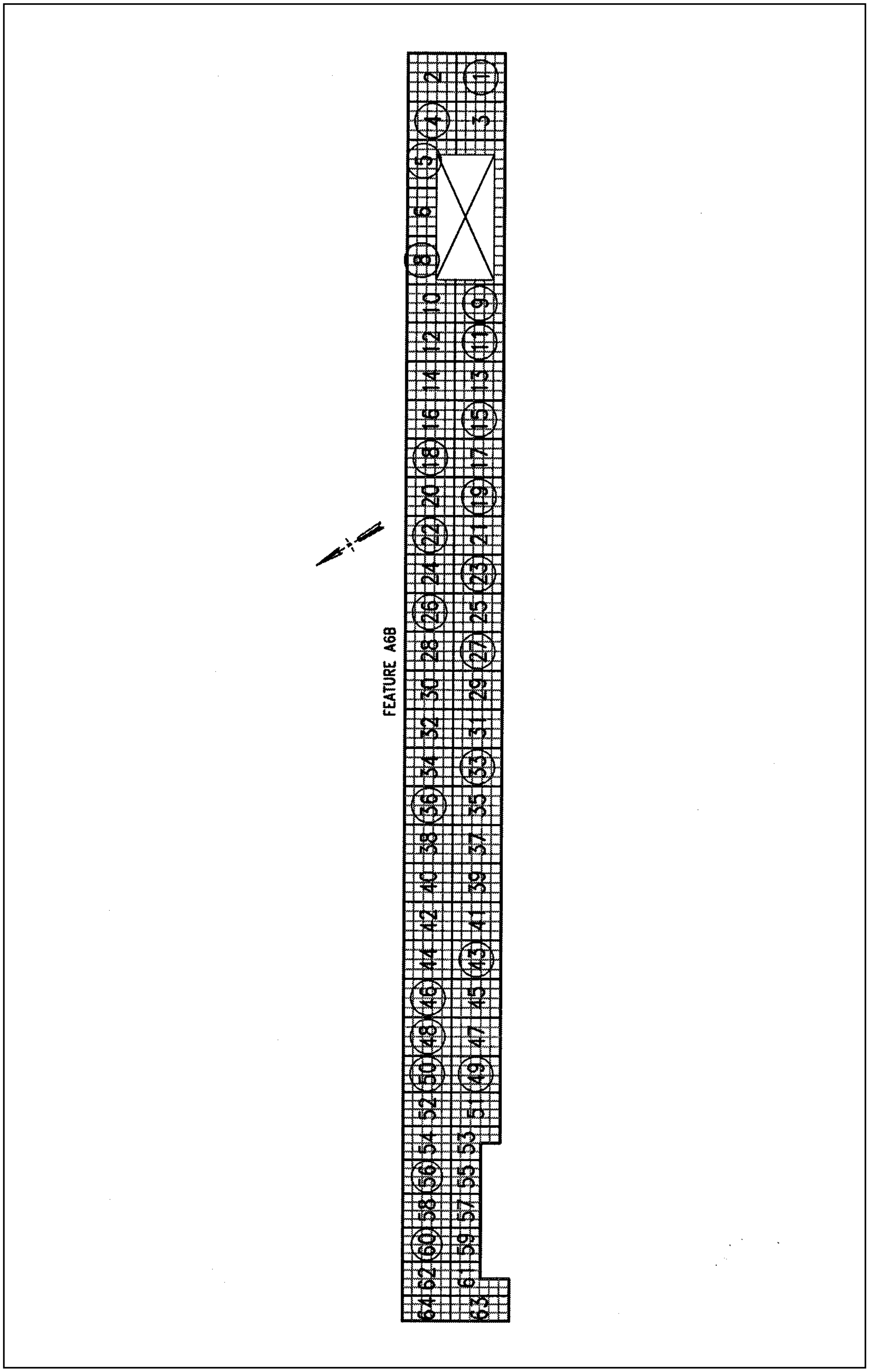

Figure C7. Sample unit layout, Charlie Parking Ramp, feature A6B

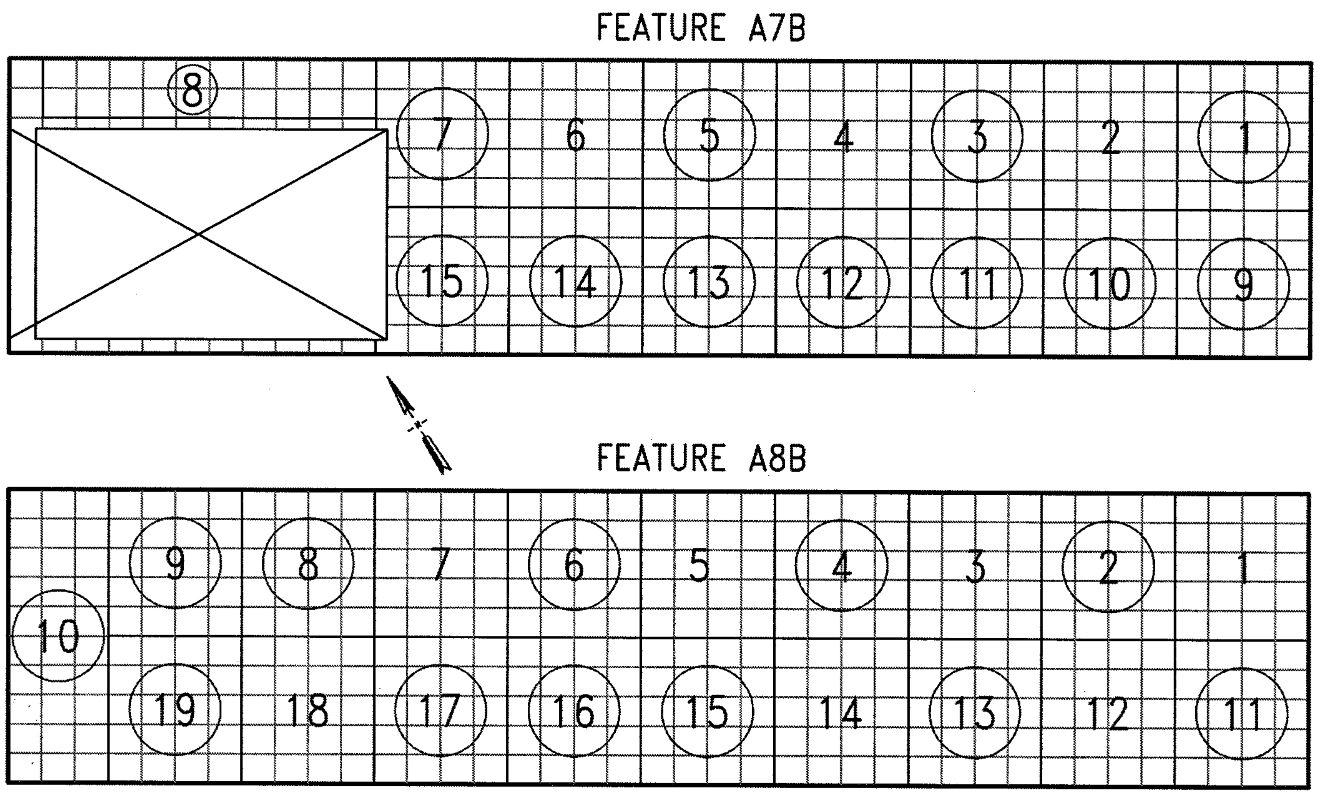

Figure C8. Sample unit layout, Delta Parking Ramp, features A7B and A8B

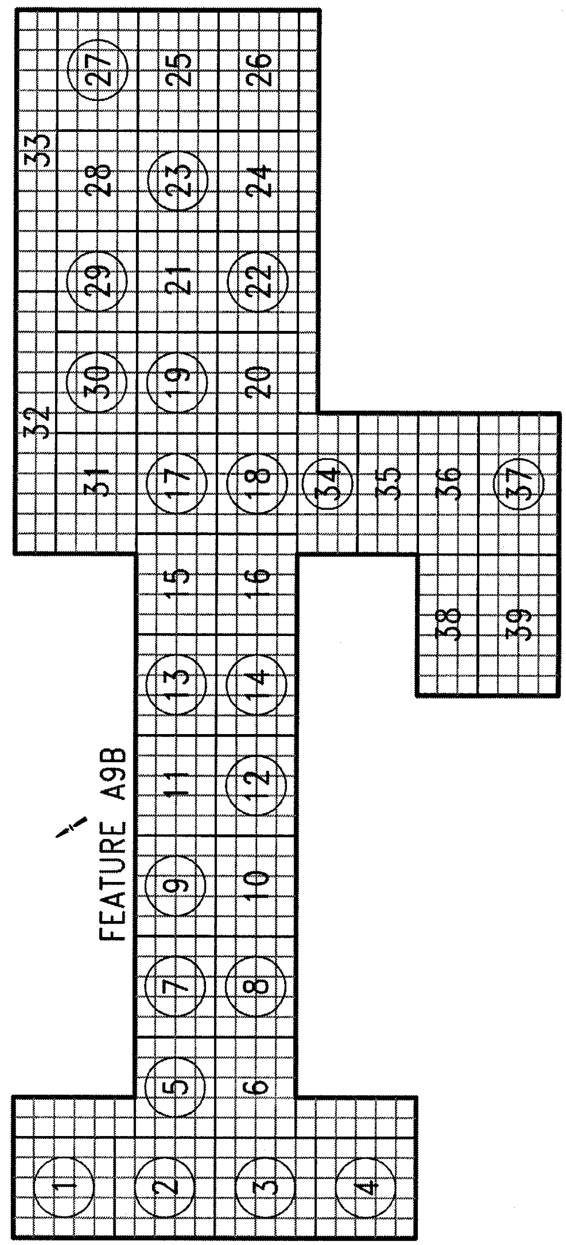

Figure C9. Sample unit layout, Delta Parking Ramp, feature A9B

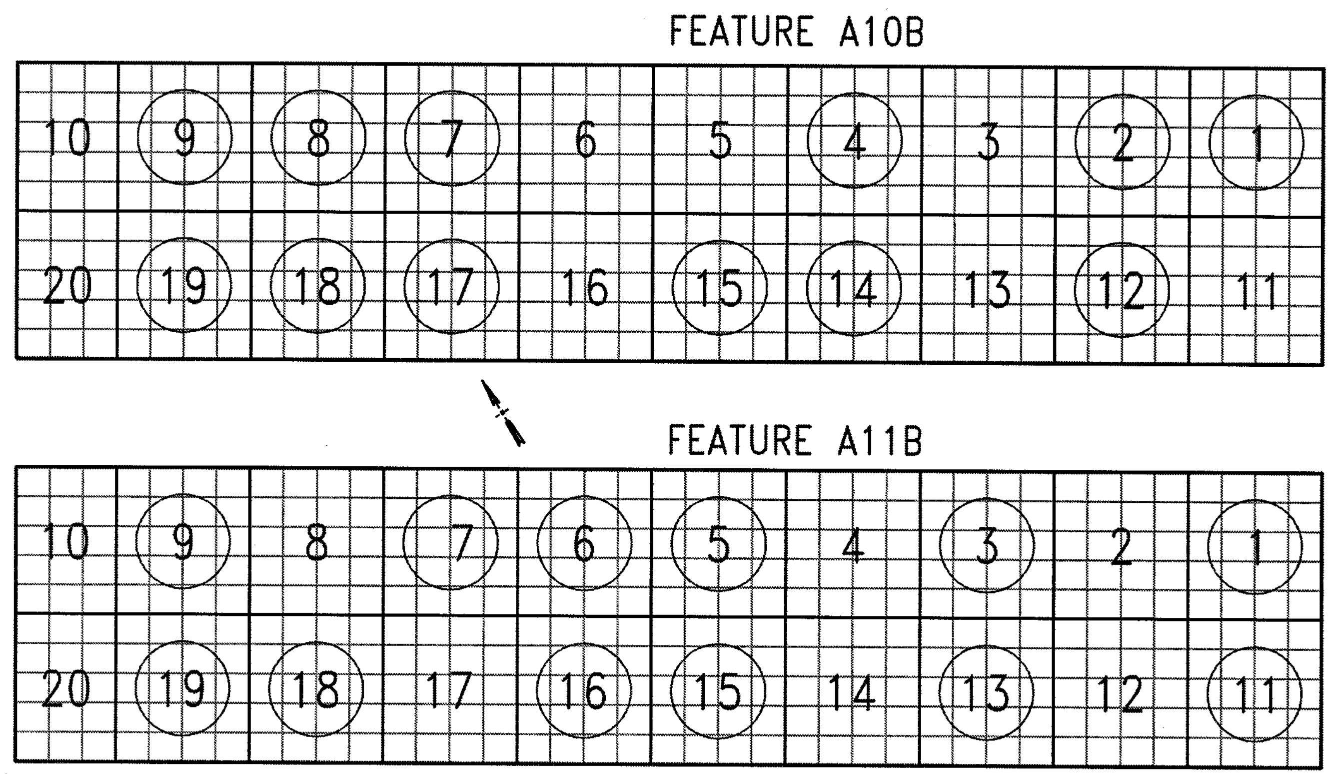

Figure C10. Sample unit layout, b East and B West Parking Ramps, feature A10B and A11B, respectively

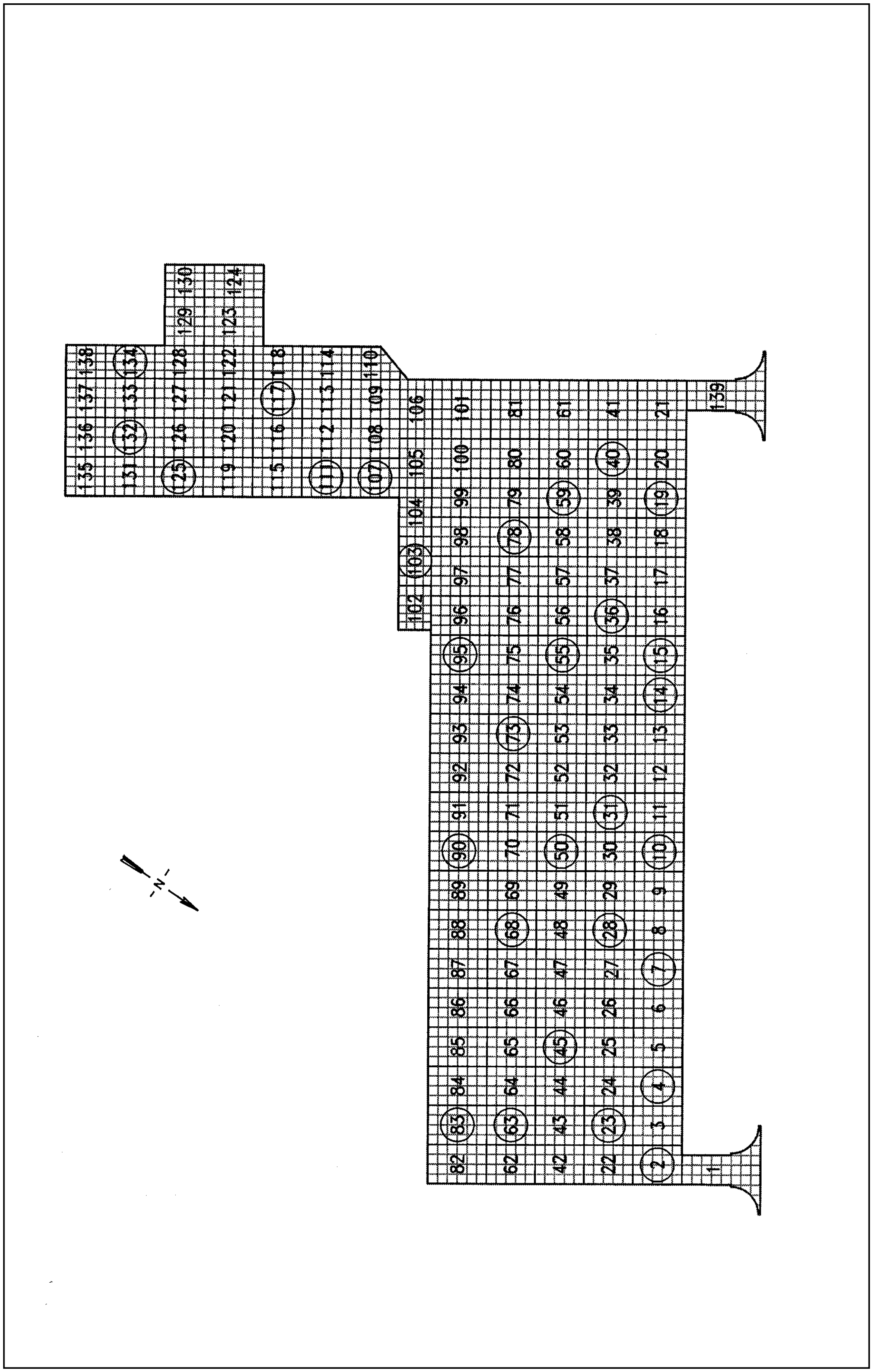

Figure C11. Sample unit layout, Alpha Ramp, feature A13B

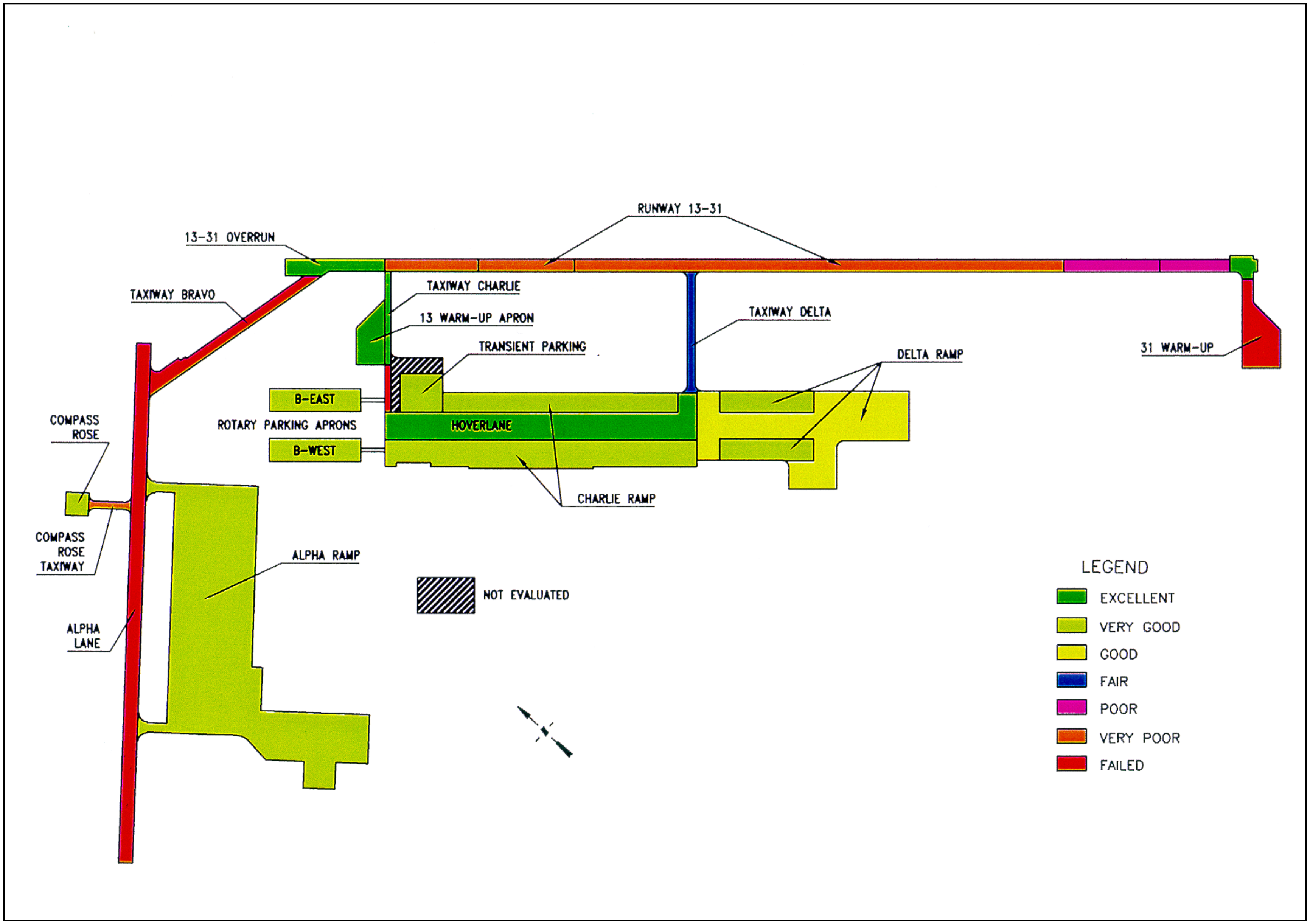

Figure C12. Pavement condition rating summary

Table C1
Comparison of 1993, 1995, and 2002 PCI Surveys

Feature	1993 PCI	1995 PCI	2002 PCI	2002 Rating	Change in PCI From 1995 to 2002 (+ or -)	Pavement Type
Runway						
R1A	3	3	92	Excellent	89	AC
R2A	74	58	25	Very poor	-33	AC
R3A	70	59	14	Very poor	-35	AC
R4A	72	55	22	Very poor	-33	AC
R5A	71	55	26	Poor	-29	AC
R6A	74	59	33	Poor	-26	AC
R7A	--	--	93	Excellent	--	PCC
Taxiways						
T1A	2	3	2	Failed	-1	AC
T2A	17	3	90	Excellent	+87	AC
T3A	68	49	50	Fair	+1	PCC
T4B	28	22	19	Very poor	-3	AC
T5A	24	5	5	Failed	--	AC
T6A	17	3	5	Failed	+2	AC
Aprons and Ramps						
A1B	17	5	92	Excellent	+87	PCC
A2B	2	3	5	Failed	+2	AC
A3B	26	4	93	Excellent	+89	AC
A4B	97	82	82	Very good	--	PCC
A5B	97	83	84	Very good	+1	PCC
A6B	95	76	78	Very good	+2	PCC
A7B	94	80	80	Very good	--	PCC
A8B	93	86	80	Very good	-6	PCC
A9B	83	66	64	Good	-2	PCC
A10B	88	85	84	Very good	-1	PCC
A11B	84	81	85	Very good	+4	PCC
A12B	88	79	84	Very good	+5	PCC
A13B	100	92	81	Very good	-9	PCC

Photo C1. Alpha Ramp, Feature A13B, medium-severity longitudinal crack

Photo C2. Alpha Lane, Feature T5A, high-severity block cracking and weathering

Photo C3. Taxiway Bravo, Feature T1A, high-severity rutting

Photo C4. Runway 13-31, Feature R6A, low-severity slippage cracks

Photo C5. Runway 13-31, Feature R7A, new PCC

Photo C6. Charlie Ramp, Feature A5B, medium-severity fault

Photo C7. Delta Ramp, Feature A9B, high-severity corner spalling

Photo C8. Delta Ramp, Feature A7B, high-severity “D” cracking

Photo C9. Alpha Ramp, Feature A13B, low-severity “D” cracking

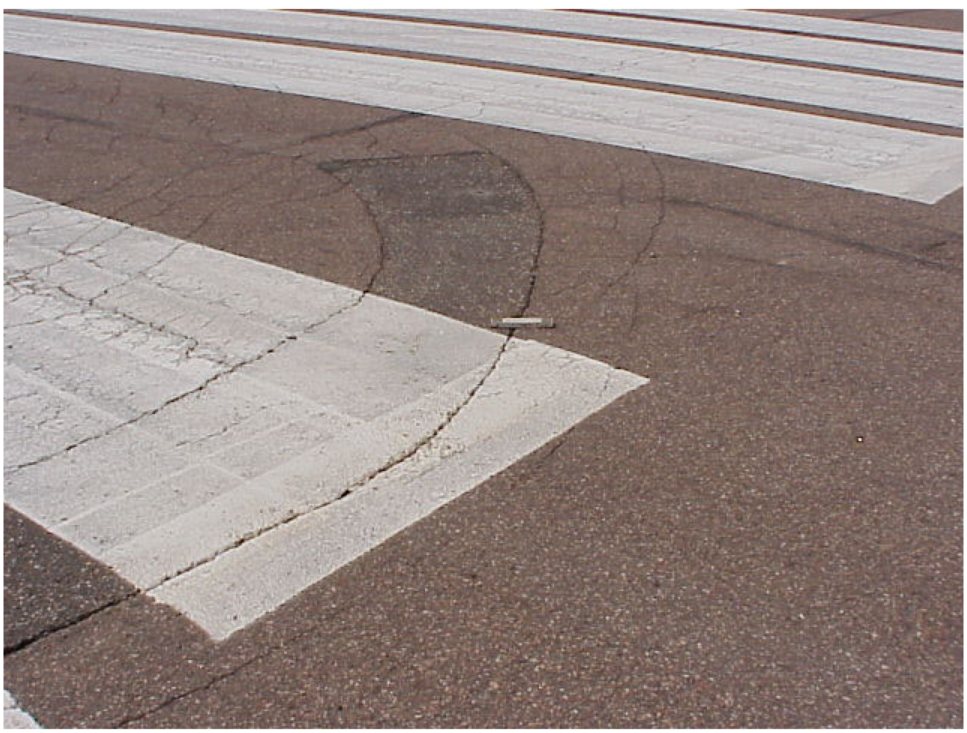

Photo C10. Runway 13-31, Feature R2A, high-severity patch of slippage damage

Appendix D
Structural Analyses

General

The performance of the airfield pavement facilities was analyzed for the traffic shown in Table D1.

The operational ACN values determined for the C-130 and CH-47 aircrafts are shown in Table D2 for the four subgrade strength categories.

In a wartime scenario, aircraft may be required to operate at weights that exceed normal peacetime loads. These aircraft would have a higher ACN, would cause more damage, and reduce the life of the pavement. A mobilization ACN can be determined from the appropriate ACN-PCN curve presented in ETL 1110-3-394 (Headquarters, Department of the Army 1991). Typical ACN-PCN curves for the C-130 and CH-47 aircrafts are shown in Figures D1 and D2, respectively. For contingency planning, it is often necessary to determine the largest aircraft that can safely land on an airfield. Runway length is a critical factor in this determination. Minimum take-off distances for maximum take-off weights of aircraft are also given in ETL 1110-3-394 (Headquarters, Department of the Army 1991). For a specified aircraft, the ACN can be determined from the ACN-PCN curve and then the effect of the higher loads on the airfield can be determined from the ACN/PCN ratio. Specific aircraft mobilization traffic requirements are contained in classified mobilization plans and are not included in this report.

ACN-PCN Method of Reporting Pavement Structural Condition

The ACN-PCN method is structured so that the structural evaluation of a pavement for a particular aircraft can be accomplished by using the ratio of the aircraft ACN to the pavement PCN. For a given pavement life and a given number of operations of a particular aircraft, there is a relationship between the ACN/PCN ratio and the percent of pavement life used by the applied traffic. For a given ACN/PCN ratio, a relationship exists for the number of operations that will produce failure of the pavement. These relationships provide a method for evaluating a pavement for allowable load depending on an acceptable degree of damage to the pavement or an allowable number of operations of a particular aircraft to cause failure of a pavement. For aircraft having an ACN equal to the PCN, the predicted failure of the pavement would equal the design life of the pavement. Aircraft having ACN's higher than the pavement PCN would overload the pavement and decrease the life of the pavement. Likewise if the ACN of the operational aircraft were less than the pavement PCN, the life of the pavement would be greater than the design life. If the operational ACN is greater than the pavement PCN and a decrease in pavement life is not acceptable, then structural improvement of the pavement is required to bring the pavement PCN up to or greater than the operational ACN.

PCN Analysis

Modulus values shown in Appendix B were input into the computerized Layered Elastic Evaluation Program (LEEP) to determine the load-carrying capacity of each pavement feature in accordance with UFC 3-260-03 (Headquarters, Departments of the Army, Navy, and the Air Force 2001a). Using the design aircraft and traffic levels for normal operations, a PCN was determined for each pavement feature. The PCN is determined using the allowable gross aircraft load and the subgrade strength category. To determine the subgrade category, backcalculated subgrade moduli were converted to CBR values using the correlation E = 1500 (CBR). Table D3 presents a summary of the evaluation of each pavement feature in terms of allowable gross aircraft loadings, PCN, and overlay thicknesses required to increase the structural capacity such that the mission traffic can be supported (PCN ≥ operational ACN). The Airfield Pavement Evaluation Chart (APEC) presented in Illustration 1, Executive Summary, shows a layout of the airfield pavements and corresponding PCN for each facility.

The PCN codes and PCI for each feature were analyzed to establish ISR ratings listed in Table 3-1. An ISR Rating for each pavement facility is shown in Illustration 2, Executive Summary. AR 420-72 (Headquarters Department of the Army 2000) requires that the following ACN/PCN ratios be used in determining ISR ratings for airfield pavement facilities.

ACN/PCN ≤ 1.0 equals an ISR Green rating
1.0 < ACN/PCN ≤ 1.5 equals an ISR Amber rating
ACN/PCN > 1.5 equals an ISR Red rating

For those features having a PCN< the required operational ACN, the additional pavement thickness (overlay) needed to support the mission traffic was computed. Although the required increase in pavement strength is presented as an overlay thickness, several other approaches could be considered. A detailed analysis will be required to select and design the most cost-effective repair or improvement alternative. It should be noted that although less than 102 mm (4-in.) -thick AC overlay requirements are indicated in Table D3, the following minimum thicknesses are recommended in UFC 3-260-2 (Headquarters, Departments of the Army, Navy, and the Air Force 2001b):

a. 51 mm (2-in.) -thick minimum AC overlay over AC pavements.

b. 102 mm (4-in.) -thick minimum AC overlay over PCC pavements.

c. 152 mm (6-in.) -thick minimum PCC partially or nonbonded overlay.

d. 51 mm (2-in.) -thick minimum PCC fully bonded overlay over PCC pavements.

These minimum overlay requirements are required to control the degree of cracking which will occur in the base pavement (existing pavement) due to the application of the design traffic. If those features needing structural improvements are not upgraded in a timely manner pavement may deteriorate rapidly and result in damage to all pavement layers and an increase in cost for the necessary improvements. Excessive damage may also result in lengthy closures of the pavement facility.

The PCN codes for the weakest feature within each pavement facility are shown in Table D4. The PCN code includes the PCN numerical value, pavement type, subgrade category, allowable tire pressure, and method used to determine the PCN. An example of a PCN code is: 30/F/A/W/T, with 30 expressing the numerical PCN value, F indicating a flexible pavement, A indicating high strength subgrade, W indicating high-allowable tire pressure, and T indicating that the PCN value was obtained by a technical evaluation. Table D5 presents a description of the letter codes comprising the PCN code. Each PCN assumes that only the design aircraft will be used for the stated number of passes. Theoretically, if the PCN is equal to the ACN, the pavement should perform satisfactorily and require only routine maintenance through the length of the analysis period. There may be situations when it is necessary to overload a pavement, i.e., the ACN is greater than the PCN. Examples are emergency landings, short-term contingencies, exercises, and air shows. Pavements can usually support some overload; however, pavement life can be reduced. If the PCN were less than the ACN, the ACN/PCN ratio would be greater than 1 and the pavement would be expected to fail before reaching the end of the analysis period. As a general rule, ACN/PCN ratios of up to 1.25 have minimal impact on pavement life. If the ACN/PCN ratio is between 1.25 and 1.50, aircraft operations should be limited to 10 passes and the pavement inspected after each operation. Aircraft operations resulting in an ACN/PCN ratio over 1.50 should not be allowed except for emergencies. An example of how to use the ACP/PCN method to determine if an aircraft will overload a pavement is shown below.

Example Problem

Runway 13-31, taxiway C or D, and the Charlie Parking Ramp must be used for 1,000 passes of a C-130 aircraft operating at a take-off weight of 49 900 kg (110,000 lb). Find the weakest features on each facility and determine if they can support this traffic?

Solution

From Table D3, determine the PCN for the weakest feature on R/W 13-31, and for taxiways C and D, and for Charlie Parking Ramp; from Figure D1 determine the ACN of a 49 900 kg (110,000 lb) C-17, and then calculate the ACN/PCN ratio using the appropriate PCN from Table D3.

a. Runway 13-31.

Weakest feature is R1A (see Table D3)
PCN for R1A = 11/F/C/W/T
ACN for a 50 900 kg (110,000 lb) C-130 on a low strength subgrade = 21/F/C/W/T (see Figure D1).
ACN/PCN ratio is 21/11 or 1.9; therefore R/W 15-33 should only be used in an emergency.

b. Taxiway C.

Weakest feature is T6A
PCN for T6A = 8/F/B/W/T
ACN for a C-130 on a medium strength subgrade = 19/F/B/W/T (see Figure D1).
ACN/PCN ratio is 19/8 or 2.4; therefore aircraft operations on T6A should also be limited to emergencies.

c. Taxiway D.

PCN for T3A = 32/R/C/W/T
ACN for a C-130 on a low strength subgrade = 23/R/C/W/T (see Figure D1).
ACN/PCN ratio is 23/32 or 0.7; therefore T3A should perform satisfactorily.

d. Charlie Parking Ramp.

Weakest feature is A6B.
PCN for A6B = 21/R/D/W/T
ACN for a C-130 on a low strength subgrade = 24/R/D/W/T (see Figure D1).
ACN/PCN ratio is 24/21 or 1.1; therefore the overload on A6B will have minimal impact on the pavement life.

A summary of the evaluation of the controlling feature of each pavement facility in terms of PCN for the thaw-weakened period (November through March) is shown in Table D4. When a pavement is not properly designed and constructed to withstand the detrimental effects of winter, one or both of the following will occur: nonuniform heave due to ice lenses or loss of strength during the thaw period. Thaw-weakened periods, which generally occur during the time period of November through March, are based on the climatological data shown in Table A1. During this period, several to many cycles of freezing and thawing will occur. Loss of strength will take place during thaw periods in those pavements that have not been properly designed and constructed to prevent such loss. The degree of strength loss depends upon the depth of frost and subsequent thawing. The depth of frost penetration 635 mm (25 in.) was determined from the climatological data summary for BAAF. Typical soils in the area are high frost susceptible and have a frost code of F-3. The base and subbase materials are frost susceptible and have a frost code of F-1. PCN's for the thaw-weakened periods are provided as guidance to the airfield operator for managing airfield operations during the November through March time frame.

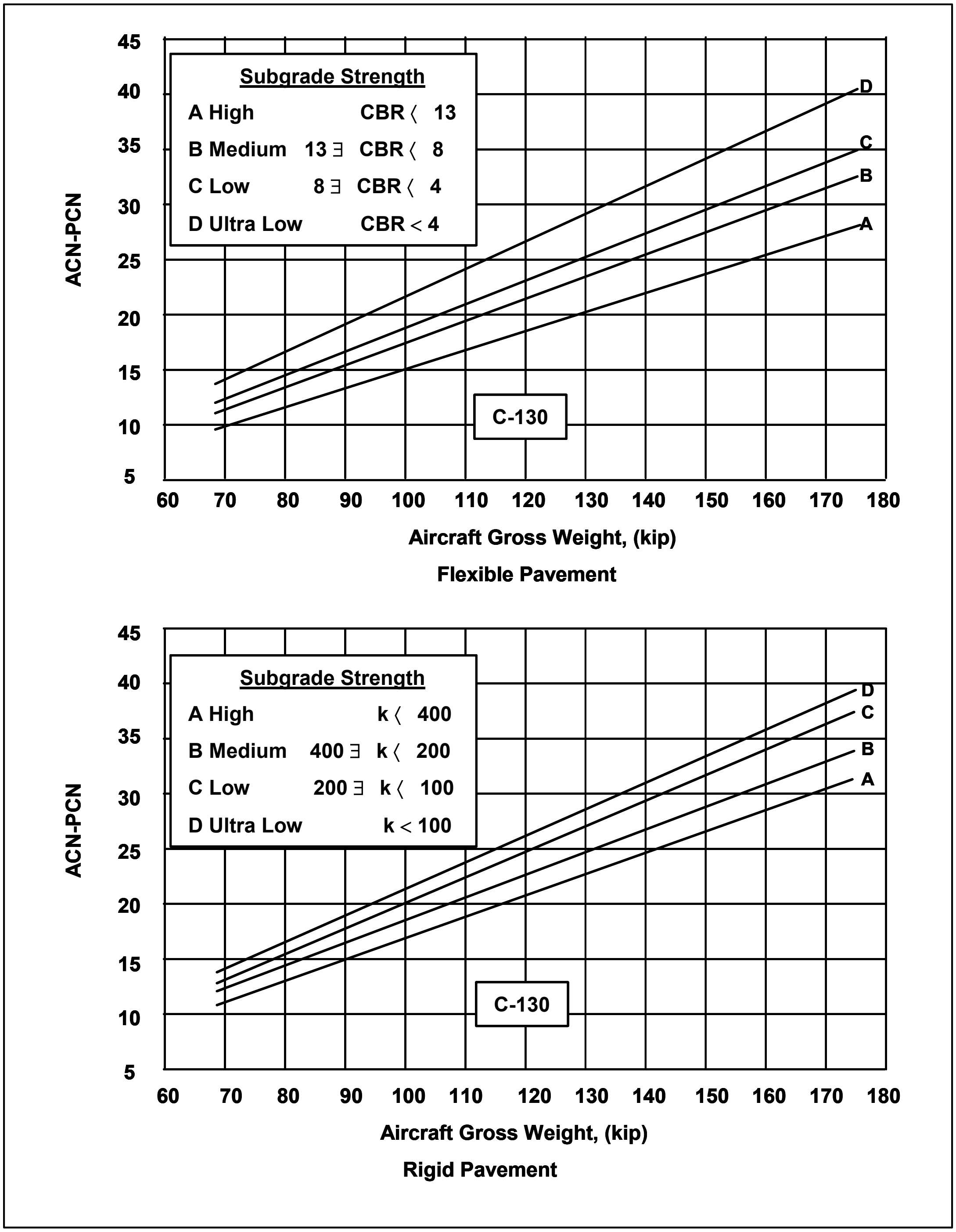

Figure D1. ACN-PCN curve for C-130

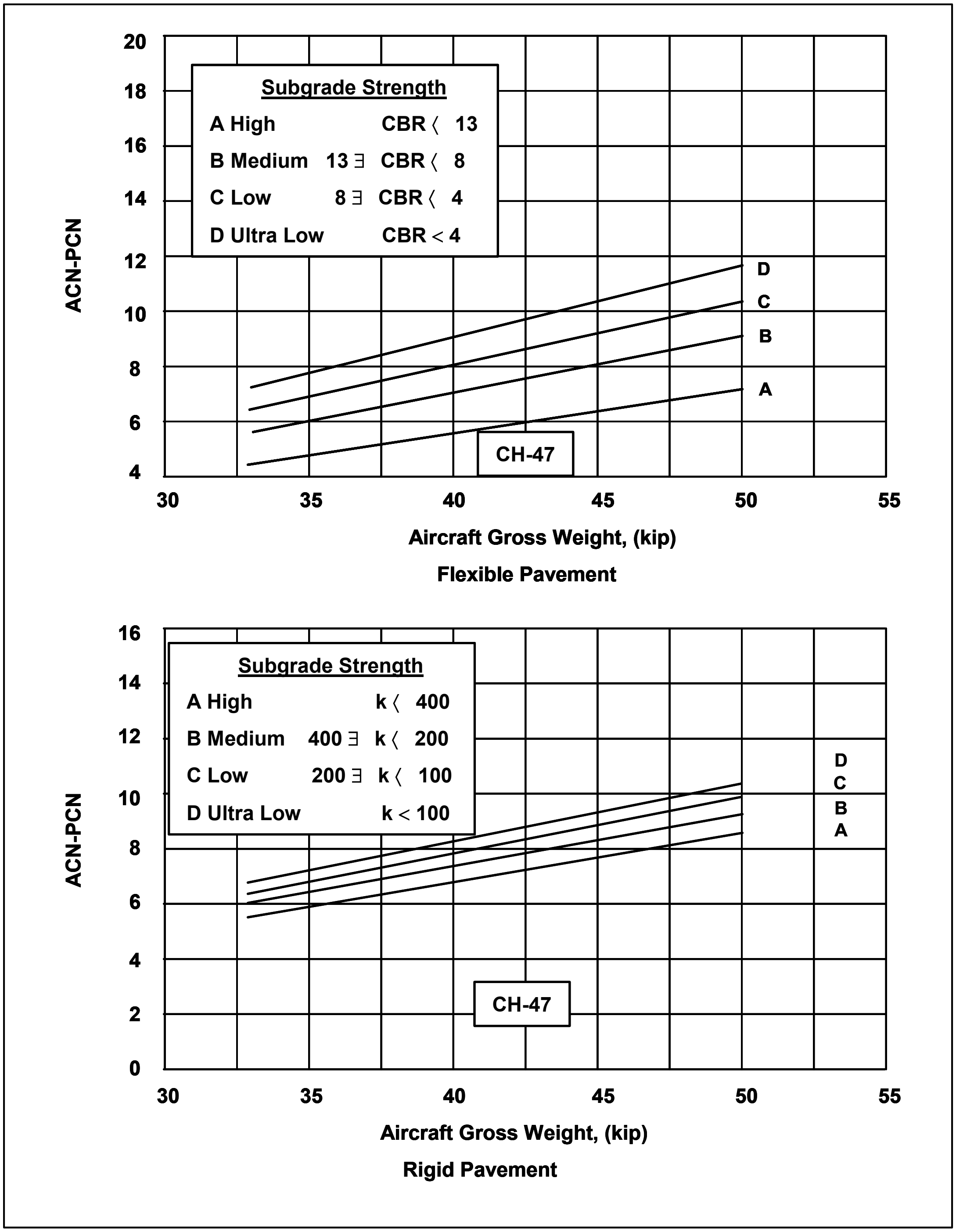

Figure D2. ACN-PCN curve for CH-47

Table D1
Determination of Critical Aircraft and Design Traffic

Fixed-Wing Pavements			
Fixed-Wing Aircraft	**Gross Weight kg (lb)**	**20-year Projected Aircraft Passes**	**20-year Equivalent C-130 Passes**
C-130	70 300 (155,000)	6,000	6,000
20-year Total Equivalent C-130 passes @ 70 300 (155,000) = 6,000			
Rotary-Wing Pavements			
Fixed-Wing Aircraft	**Gross Weight kg (lb)**	**20-year Projected Aircraft Passes**	**20-year Equivalent CH-47 Passes**
CH-47	22 700 (50,000)	50,000	50,000
20-year Total Equivalent CH-47 passes @ 22 700 (50,000) = 50,000			

Table D2
Determination of ACN Values for the Critical Aircraft

Design Aircraft	Weight kg (lb)	Subgrade Category[1]	ACN or Required PCN
Fixed-Wing AC Pavements			
C-130	70 300 (155,000)	A	24
		B	28
		C	30
		D	36
Fixed-Wing PCC Pavements			
C-130	70 300 (155,000)	A	27
		B	30
		C	33
		D	35
Rotary-Wing AC Pavements			
CH-47	22 700 (50,000)	A	7
		B	9
		C	10
		D	12
Rotary-Wing PCC Pavements			
CH-47	22 700 (50,000)	A	9
		B	10
		C	11
		D	11

[1] See Table D5 for subgrade category.

Table D3
Allowable Gross Aircraft Loads and Overlay Requirements for the Projected Day-To-Day Traffic

Pavement Facility	Feature	Test Number or Station m (ft)	Type Traffic Area	Subgrade Strength[1] CBR, % or k, kPa/mm (psi/in.)	Design Aircraft[2]				Allowable Gross Load Mg (kips)	PCN	Theoretical Overlay Requirements, mm (in.)		
					Aircraft	Weight Kg (lb)	Passes	ACN			AC	PCC Partial Bond	PCC No Bond
Fixed-wing Facilities													
Runway 13-31	R1A[3]	0+00-1+52 (0+00-5+00)	A	6	C-130	70 300 (155,000)	6,000	30/F/C/W/T	--[4]	11/F/C/W/T	132 (5.2)[7]	NA	--[5]
	R2A[3]	1+52-3+05 (5+00-10+00)	A	11	C-130	70 300 (155,000)	6,000	28/F/B/W/T	46 (102)	18/F/B/W/T	20 (0.8)[7]	NA	--[5]
	R3A[3]	3+05-4+57 (10+00-15+00)	A	9	C-130	70 300 (155,000)	6,000	28/F/B/W/T	38 (83)	14/F/B/W/T	46 (1.8)	NA	--[6]
	R4A[3]	4+57-12+37 (15+00-40+60)	A	11	C-130	70 300 (155,000)	6,000	28/F/B/W/T	46 (102)	18/F/B/W/T	20 (0.8)[7]	NA	--[5]
	R5A[3]	12+37-13+90 (40+60-45+60)	A	11	C-130	70 300 (155,000)	6,000	28/F/B/W/T	46 (102)	18/F/B/W/T	20 (0.8)[7]	NA	--[5]
	R6A	13+90-15+12 (45+60-49+60)	A	11	C-130	70 300 (155,000)	6,000	28/F/B/W/T	46 (102)	18/F/B/W/T	20 (0.8)[7]	NA	--[5]
	R7A	15+12-15+54 (49+60-51+00)	A	66 (243)	C-130	70 300 (155,000)	6,000	30/R/B/W/T	61 (134)	26/R/B/W/T	NA	122 (4.8)	160 (6.3)
Taxiway C	T2A	0+00-1+52 (0+00-5+00)	A	86 (318)	C-130	70 300 (155,000)	6,000	30/R/B/W/T	64 (141)	27/R/B/W/T	NA	109 (4.3)	142 (5.6)
	T6A[3]	1+52-2+25 (5+00-7+37)	A	8	C-130	70 300 (155,000)	6,000	28/F/B/W/T	--[4]	8/F/B/W/T	130 (5.1)	NA	--[5]
Taxiway D	T3A	0+00-1+91 (0+00-6+27)	A	38 (141)	C-130	70 300 (155,000)	6,000	33/R/C/W/T	68 (151)	32/R/C/W/T	NA	99 (3.9)	135 (5.3)
13 Warm-up	A1B	1-5	B	82 (301)	C-130	70 300 (155,000)	6,000	30/R/B/W/T	67 (147)	28/R/B/W/T	NA	97 (3.8)	130 (5.1)
31 Warm-up	A2B[3]	1-5	B	4	C-130	70 300 (155,000)	6,000	36/F/D/W/T	--[4]	2/F/D/W/T	241 (9.5)[7]	NA	--[5]
Hoverlane	A3B[3]	1-17	B	12	C-130	70 300 (155,000)	6,000	28/F/B/W/T	--[4]	11/F/B/W/T	71 (2.8)[7]	NA	--[5]

(Continued)

[1] Values based on correlations between CBR and/or k or effective k and the backcalculated subgrade modulus.
[2] Determined for the critical aircraft (see Table D1).
[3] Used LOW (Low Volume Evaluation) computer program to compute subgrade CBR and APE (Airfield Pavement Evaluation) computer program to evaluate pavement.
[4] The allowable gross load is less than the minimum take-off weight of the critical aircraft.
[5] Was not calculated because feature was evaluated as a flexible pavement.
[6] Reconstruction is recommended because the ISM is less than the lower limit of LOW.
[7] An AC overlay is not recommended. UFC 3-260-02 (Headquarters, Departments of the Army, Navy, and the Air Force 2001b) requires that the surface be a rigid pavement.

Table D3 (Concluded)

Pavement Facility	Feature	Test Number or Station m (ft)	Type Traffic Area	Subgrade Strength[1] CBR, % or K, kPa/mm (psi/in.)	Design Aircraft[2] Aircraft	Weight Kg (lb)	Passes	ACN	Allowable Gross Load Mg (kips)	PCN	Theoretical Overlay Requirements, mm (in.) AC	PCC Partial Bond	PCC No Bond
Fixed-wing Facilities (Concluded)													
Transient Parking Ramp	A4B	1-6	B	28 (102)	C-130	70 300 (155,000)	6,000	33/R/C/W/T	50 (110)	22/R/C/W/T	NA	147 (5.8)	185 (7.3)
Charlie Parking Ramp	A5B	1-11	B	30 (109)	C-130	70 300 (155,000)	6,000	33/R/C/W/T	46 (102)	20/R/C/W/T	NA	165 (6.5)	203 (8.0)
	A6B	1-15	B	26 (95)	C-130	70 300 (155,000)	6,000	35/R/D/W/T	44 (97)	21/R/D/W/T	NA	175 (6.9)	213 (8.4)
Rotary-wing Facilities													
Taxiway B	T1A[3]	0+00-3+20 (0+00-10+50)	B	--[6]	CH-47	22 700 (50,000)	50,000	12/F/D/W/T	--[4]	1/F/D/W/T	--[6]	--[6]	--[6]
Compass Rose Taxiway	T4B[3]	0+00-0+64 (0+00-2+10)	B	9	CH-47	22 700 (50,000)	50,000	9/F/B/W/T	--[4]	4/F/B/W/T	48 (1.9)	NA	--[5]
Alpha Lane	T5A[3]	0+00-8+23 (0+00-27+00)	B	9	CH-47	22 700 (50,000)	50,000	9/F/B/W/T	--[4]	4/F/B/W/T	28 (1.1)	NA	--[5]
Delta Parking Ramp	A7B	1-3	B	29 (106)	CH-47	22 700 (50,000)	50,000	11/R/C/W/T	24 (52)	11/R/C/W/T	NA	0 (0.0)	0 (0.0)
	A8B	1-5	B	24 (89)	CH-47	22 700 (50,000)	50,000	11/R/D/W/T	23 (50)	11/R/D/W/T	NA	0 (0.0)	0 (0.0)
	A9B	1-20	B	37 (136)	CH-47	22 700 (50,000)	50,000	11/R/C/W/T	35 (77)	17/R/C/W/T	NA	0 (0.0)	0 (0.0)
B East Parking Ramp	A10B	1-5	B	27 (101)	CH-47	22 700 (50,000)	50,000	11/R/C/W/T	23 (50)	11/R/C/W/T	NA	0 (0.0)	0 (0.0)
B West Parking Ramp	A11B	1-5	B	26 (95)	CH-47	22 700 (50,000)	50,000	11/R/D/W/T	21 (47)	10/R/D/W/T	NA	74 (2.9)	99 (3.9)
Compass Rose	A12B	1-3	B	27 (100)	CH-47	22 700 (50,000)	50,000	11/R/C/W/T	22 (48)	10/R/C/W/T	NA	71 (2.8)	97 (3.8)
Alpha Ramp	A13B	1-16	B	41 (150)	CH-47	22 700 (50,000)	50,000	11/R/C/W/T	24 (53)	11/R/C/W/T	NA	0 (0.0)	0 (0.0)

[1] Values based on correlations between CBR and/or k and the backcalculated subgrade modulus.
[2] Determined for the critical aircraft (see Table D1).
[3] Used LOW (Low Volume Evaluation) computer program to compute subgrade CBR and APE (Airfield Pavement Evaluation) computer program to evaluate pavement.
[4] The allowable gross load is less than the minimum take-off weight of the critical aircraft.
[5] Was not calculated because feature was evaluated as a flexible pavement.
[6] Reconstruction is recommended because the ISM is less than the lower limit of LOW.

Table D4
Summary of Pavement Classification Numbers

Pavement Facility	Controlling Feature	PCN[1] Code Normal Non-Frost	PCN[1] Code Thaw-weakening
Fixed-wing Facilities			
Runway 13-31 Overrun	R1A	11/F/C/W/T	4/F/D/W/T
Runway 13-31	R3A	14/F/B/W/T	6/F/D/W/T
Taxiway C	T6A	8/F/B/W/T	3/F/D/W/T
Taxiway D	T3A	32/R/C/W/T	24/F/D/W/T
13 Warm-up	A1B	28/R/B/W/T	21/R/D/W/T
31 Warm-up	A2B	2/F/D/W/T	3/F/D/W/T
Hoverlane	A3B	11/F/B/W/T	2/F/D/W/T
Transient Parking Ramp	A4B	22/R/C/W/T	16/R/D/W/T
Charlie Parking Ramp	A6B	21/R/D/W/T	17/R/D/W/T
Rotary-wing Facilities			
Taxiway B	T1A	1/F/D/W/T	1/F/D/W/T
Compass Rose Taxiway	T4B	4/F/B/W/T	1/F/D/W/T
Alpha Lane	T5A	4/F/B/W/T	1/F/D/W/T
Delta Parking Ramp	A8B	11/R/D/W/T	9/R/D/W/T
B East Parking Ramp	A10B	11/R/C/W/T	8/R/D/W/T
B West Parking Ramp	A11B	10/R/D/W/T	8/R/D/W/T
Compass Rose	A12B	10/R/C/W/T	8/R/D/W/T
Alpha Ramp	A13B	11/R/C/W/T	8/R/D/W/T

[1] Table D5 describes the components of the PCN code.

Table D5
PCN Five-Part Code

PCN	Pavement Type	Subgrade Strength[1]	Tire Pressure2	Method of PCN Determination
Numerical value	R - rigid	A	W	T - technical evaluation
	F - flexible	B	X	U - using aircraft
		C	Y	
		D	Z	

[1]Code	Category	Flexible Pavement CBR, %	Rigid Pavement K, kPa/mm, (psi/in.)
A	High	〈 13	〈 108 (400)
B	Medium	13 > CBR 〈 8	108 > K 〈 54 (400 > K 〈 200)
C	Low	8 > CBR 〈 4	54 > K 〈 27 (200 > K 〈 100)
D	Ultra-low	< 4	< 27 (< 100)

[2]Code	Category	Tire Pressure, MPa (psi)
W	High	No limit
X	Medium	1.0 - 1.5 (146 - 217)
Y	Low	0.51 - 1.0 (73 - 145)
Z	Ultra-low	0 - 0.5 (0 - 72)

Appendix E
Micro PAVER Output Summary

```
Network ID      - Butts
Branch Name     - RUNWAY 13-31 Overrun      Section Length  -    500.00 LF
Branch Number   - R1A                       Section Width   -     75.00 LF
Section Number  - 1    Family - DEFAULT     Section Area    -  37500.00 SF
==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/02
  Riding Quality :             Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:               F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  92                               RATING = EXCELLENT

  TOTAL NUMBER OF SAMPLE UNITS =    5
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    5
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  0.36%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  48 L & T CR       LOW           772.00 (LF)      2.06          7.57



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES = 100.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - RUNWAY 13-31            Section Length  -    500.00 LF
Branch Number   - R2A                     Section Width   -     75.00 LF
Section Number  - 1    Family - DEFAULT   Section Area    -  37500.00 SF

==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :             Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  25                           RATING = VERY POOR

  TOTAL NUMBER OF SAMPLE UNITS =    5
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    5
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  10.7%


       *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  41 ALLIGATOR CR   LOW          1410.00 (SF)      3.76          33.32
  41 ALLIGATOR CR   MEDIUM       2530.00 (SF)      6.74          51.04
  43 BLOCK CR       LOW          2997.00 (SF)      7.99          15.82
  43 BLOCK CR       MEDIUM       5919.00 (SF)     15.78          27.23
  48 L & T CR       LOW          1372.00 (LF)      3.66          11.70
  48 L & T CR       MEDIUM        821.00 (LF)      2.19          16.48
  50 PATCHING       LOW            67.00 (SF)      0.18           2.01
  52 WEATH?RAVEL    LOW         37500.00 (SF)    100.00          26.34
  53 RUTTING        LOW           940.00 (SF)      2.51          19.66
  53 RUTTING        MEDIUM       2248.00 (SF)      5.99          38.09


     *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD              RELATED DISTRESSES =  59.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES =  41.00 PERCENT DEDUCT VALUES.
  OTHER             RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - RUNWAY 13-31              Section Length  -    500.00 LF
Branch Number   - R3A                       Section Width   -     75.00 LF
Section Number  - 1    Family - DEFAULT     Section Area    -  37500.00 SF

==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  14                             RATING = VERY POOR

  TOTAL NUMBER OF SAMPLE UNITS =    5
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    5
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  2.2%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  41 ALLIGATOR CR   LOW          2774.00 (SF)      7.40           40.13
  41 ALLIGATOR CR   MEDIUM       4580.00 (SF)     12.21           58.88
  48 L & T CR       LOW          1298.00 (LF)      3.46           11.21
  48 L & T CR       MEDIUM        959.00 (LF)      2.56           17.89
  52 WEATH?RAVEL    LOW         37500.00 (SF)    100.00           26.34
  53 RUTTING        LOW          1199.00 (SF)      3.20           20.98
  53 RUTTING        MEDIUM       2667.00 (SF)      7.11           39.69


      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =  74.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES =  26.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - RUNWAY 13-31              Section Length  -   2560.00 LF
Branch Number   - R4A                       Section Width   -     75.00 LF
Section Number  - 1    Family - DEFAULT     Section Area    - 192000.00 SF

==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :           Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:             F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  22                              RATING = VERY POOR

  TOTAL NUMBER OF SAMPLE UNITS =    25
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    10
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    7 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  8.3%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  41 ALLIGATOR CR   LOW         19483.00 (SF)     10.15           43.41
  41 ALLIGATOR CR   MEDIUM       6813.00 (SF)      3.55           42.99
  48 L & T CR       LOW          7808.00 (LF)      4.07           12.68
  48 L & T CR       MEDIUM       6312.00 (LF)      3.29           20.48
  52 WEATH?RAVEL    LOW        153436.00 (SF)     79.92           24.27
  52 WEATH?RAVEL    MEDIUM      19180.00 (SF)      9.99           20.67
  53 RUTTING        LOW          6859.00 (SF)      3.57           21.61
  53 RUTTING        MEDIUM       3962.00 (SF)      2.06           29.34


      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =  64.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES =  36.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - RUNWAY 13-31            Section Length  -    500.00 LF
Branch Number   - R5A                     Section Width   -     75.00 LF
Section Number  - 1    Family - DEFAULT   Section Area    -  37500.00 SF

==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :           Safety:      Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  26                             RATING = POOR

  TOTAL NUMBER OF SAMPLE UNITS =    5
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    5
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  1.7%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  41 ALLIGATOR CR   LOW          1881.00 (SF)      5.01           36.20
  48 L & T CR       LOW          2473.00 (LF)      6.60           17.93
  48 L & T CR       MEDIUM       1259.00 (LF)      3.36           20.72
  52 WEATH?RAVEL    LOW         37500.00 (SF)    100.00           26.34
  53 RUTTING        LOW          3679.00 (SF)      9.81           28.21
  53 RUTTING        MEDIUM       1161.00 (SF)      3.11           32.45


      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =  60.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES =  40.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - RUNWAY 13-31              Section Length  -    400.00 LF
Branch Number   - R6A                       Section Width   -     75.00 LF
Section Number  - 1    Family - DEFAULT     Section Area    -  30000.00 SF

==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :             Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  33                              RATING = POOR

  TOTAL NUMBER OF SAMPLE UNITS =    4
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    3
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  2.23%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  41 ALLIGATOR CR   LOW          2338.00 (SF)      7.79          40.67
  43 BLOCK CR       LOW           959.00 (SF)      3.20          11.71
  48 L & T CR       LOW          2558.00 (LF)      8.53          21.16
  48 L & T CR       MEDIUM       1049.00 (LF)      3.50          21.18
  52 WEATH?RAVEL    LOW         30000.00 (SF)    100.00          26.34
  53 RUTTING        LOW          1559.00 (SF)      5.19          23.86



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =  45.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES =  55.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - RUNWAY 13-31                  Slab Length     -     20.00 LF
Branch Number   - R7A                           Slab Width      -     18.75 LF
Section Number  - 1    Family - DEFAULT          Number of Slabs -     39
==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:        Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  93                               RATING = EXCELLENT

  TOTAL NUMBER OF SAMPLE UNITS =    2
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    2
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  4.2%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  72 SHAT. SLAB     LOW            1 (SLABS)        3.03         7.34
  73 SHRINKAGE CR   LOW            1 (SLABS)        3.03         0.86



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =  90.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =  10.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - TAXIWAY Bravo            Section Length  -  1050.00 LF
Branch Number   - T1A                      Section Width   -    50.00 LF
Section Number  - 1    Family - DEFAULT    Section Area    - 52500.00 SF
==========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :             Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:               F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  2                              RATING = FAILED

  TOTAL NUMBER OF SAMPLE UNITS =    10
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    7
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =    0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  1.8%


       *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE


  41 ALLIGATOR CR   HIGH          599.00 (SF)      1.15           37.68
  43 BLOCK CR       HIGH        50946.00 (SF)     97.04           77.78
  48 L & T CR       MEDIUM        172.00 (LF)      0.33            6.79
  48 L & T CR       HIGH           30.00 (LF)      0.10            7.50
  52 WEATH?RAVEL    HIGH        52500.00 (SF)    100.00           69.91
  53 RUTTING        LOW           862.00 (SF)      1.64           17.54
  53 RUTTING        MEDIUM        614.00 (SF)      1.17           25.37
  53 RUTTING        HIGH          629.00 (SF)      1.20           35.56


    *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =  42.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  58.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - TAXIWAY Charlie             Slab Length     -    20.00 LF
Branch Number   - T2A                         Slab Width      -    20.00 LF
Section Number  - 1    Family - DEFAULT        Number of Slabs -     50
==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:               F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  90                               RATING = EXCELLENT

  TOTAL NUMBER OF SAMPLE UNITS =    3
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    2
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    3 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  6.3%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  73 SHRINKAGE CR   NA             3 (SLABS)        6.00         1.18
  74 JOINT SPALL    LOW           20 (SLABS)       40.00         9.59
  75 CORNER SPALL   LOW            2 (SLABS)        4.00         1.47



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =    0.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES =    0.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =  100.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - TAXIWAY DELTA             Slab Length     -     20.00 LF
Branch Number   - T3A                       Slab Width      -     20.00 LF
Section Number  - 1    Family - DEFAULT      Number of Slabs -     74
==========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  50                              RATING = FAIR

  TOTAL NUMBER OF SAMPLE UNITS =    3
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    3
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    3 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  1.0%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  65 JT SEAL DAM    HIGH          74 (SLABS)     100.00         12.00
  71 FAULTING       LOW            7 (SLABS)      10.00          8.38
  73 SKRINKAGE CR   LOW            1 (SLABS)       1.67           .80
  74 JOINT SPALL    LOW           41 (SLABS)      58.33         11.83
  74 JOINT SPALL    MEDIUM         8 (SLABS)      11.67          8.83
  74 JOINT SPALL    HIGH           6 (SLABS)       8.33         18.66
  75 CORNER SPALL   LOW           23 (SLABS)      33.33         10.37
  75 CORNER SPALL   MEDIUM         2 (SLABS)       3.33          2.32
  75 CORNER SPALL   HIGH           1 (SLABS)       1.67          2.72


      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  16.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  84.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - COMPASS ROSE TAXIWAY       Section Length  -    210.00 LF
Branch Number   - T4B                        Section Width   -     40.00 LF
Section Number  - 1    Family - DEFAULT      Section Area    -   8400.00 SF
===========================================================================

  -------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  -------------------------------------------------------------------------

  PCI OF SECTION =  19                             RATING = VERY POOR

  TOTAL NUMBER OF SAMPLE UNITS =    2
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    2
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =    0
  RECOMMENDED MINIMUM OF    2 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED = 10.0%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY      QUANTITY       DENSITY %   DEDUCT VALUE

  48 L & T CR       LOW            73.00 (LF)      0.87          4.70
  48 L & T CR       MEDIUM        178.00 (LF)      2.12         16.21
  48 L & T CR       HIGH          430.00 (LF)      5.12         41.54
  52 WEATH?RAVEL    HIGH         8400.00 (SF)    100.00         69.91



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES = 100.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
```

```
 Network ID      - Butts
Branch Name     - ALPHA LANE                    Section Length  -   2700.00 LF
Branch Number   - T5A                           Section Width   -     75.00 LF
Section Number  - 1    Family - DEFAULT         Section Area    - 202500.00 SF
============================================================================

  -------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  -------------------------------------------------------------------------

  PCI OF SECTION =  5                               RATING = FAILED

  TOTAL NUMBER OF SAMPLE UNITS =    27
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =  12
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =    0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED = 0.0%


       *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  43 BLOCK CR       HIGH         202500.00 (SF)    100.00         78.00
  52 WEATH?RAVEL    HIGH         202500.00 (SF)    100.00         69.91



    *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES = 100.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - TAXIWAY CHARLIE              Section Length  -    237.00 LF
Branch Number   - T6A                          Section Width   -     40.00 LF
Section Number  - 1    Family - DEFAULT        Section Area    -   9480.00 SF
==========================================================================

  ------------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ------------------------------------------------------------------------

  PCI OF SECTION =  5                              RATING = FAILED

  TOTAL NUMBER OF SAMPLE UNITS =    2
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    2
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =    0
  RECOMMENDED MINIMUM OF    2 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED = 0.0%


       *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY       DENSITY %   DEDUCT VALUE

  43 BLOCK CR       HIGH         9480.00 (SF)    100.00         78.36
  52 WEATH?RAVEL    HIGH         9480.00 (SF)    100.00         69.91



    *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD               RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES = 100.00 PERCENT DEDUCT VALUES.
  OTHER              RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
```

```
Network ID       - Butts
Branch Name      - 13 WARM-UP RAMP              Slab Length     -     20.00 LF
Branch Number    - A1B                          Slab Width      -     20.00 LF
Section Number   - 1    Family - DEFAULT         Number of Slabs -     105
===========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  92                               RATING = EXCELLENT

  TOTAL NUMBER OF SAMPLE UNITS =    5
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    5
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED = 2.5%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  74 JOINT SPALL    LOW           29 (SLABS)      27.45          7.51
  75 CORNER SPALL   LOW            1 (SLABS)       1.00          0.30



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES = 100.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - BUTTS
Branch Name     - 31 WAR-UP RAMP              Section Length  -    390.00 LF
Branch Number   - A2B                         Section Width   -    190.00 LF
Section Number  - 1    Family - DEFAULT       Section Area    -  52250.00 SF
==========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :             Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:               F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  5                                RATING = FAILED

  TOTAL NUMBER OF SAMPLE UNITS =  11
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    7
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =    0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  5.8%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE


  43 BLOCK CR       HIGH       52250.00 (SF)    100.00           78.38
  52 WEATH/RAVEL    HIGH       52250.00 (SF)    100.00           69.91


      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY RELATED DISTRESSES = 100.00 PERCENT DEDUCT VALUES.
  OTHER               RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
```

```
Network ID      - BUTTS
Branch Name     - HOVERLANE                  Section Length  -   1650.00 LF
Branch Number   - A3B                        Section Width   -    150.00 LF
Section Number  - 1    Family - DEFAULT     Section Area    -  247500.00 SF
==========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  93                              RATING = EXCELLENT

  TOTAL NUMBER OF SAMPLE UNITS =    49
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =     8
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF    5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  1.6%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  48 L & T CR       LOW         4019.00 (LF)      1.62           6.43



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES = 100.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =    .00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - TRANSIENT PARKING         Slab Length     -     12.50 LF
Branch Number   - A4B                       Slab Width      -     11.00 LF
Section Number  - 1    Family - DEFAULT      Number of Slabs -     324
===========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  82                              RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    16
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    9
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  9.5%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  63 LINEAR CR      LOW            9 (SLABS)       2.78          2.81
  65 JT SEAL DAM    LOW           36 (SLABS)      11.00          2.00
  65 JT SEAL DAM    HIGH         288 (SLABS)      89.00         12.00
  67 LARGE PATCH    MEDIUM         4 (SLABS)       1.11          3.05
  67 LARGE PATCH    HIGH           4 (SLABS)       1.11          4.01
  68 POPOUTS        LOW            2 (SLABS)       1.00          0.90
  73 SHRINKAGE CR   LOW            4 (SLABS)       1.11          0.70
  74 JOINT SPALL    LOW            2 (SLABS)       1.00          0.60
  75 CORNER SPALL   LOW            4 (SLABS)       1.11          0.42
  75 CORNER SPALL   MEDIUM         2 (SLABS)       1.00          1.20



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                  RELATED DISTRESSES =  10.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY    RELATED DISTRESSES =  51.00 PERCENT DEDUCT VALUES.
  OTHER                 RELATED DISTRESSES =  39.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - CHARLIE PARKING            Slab Length     -    12.50 LF
Branch Number   - A5B                        Slab Width      -    11.00 LF
Section Number  - 1    Family - DEFAULT      Number of Slabs -     990
==========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  84                              RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    50
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    19
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 8 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  7.9%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  62 CORNER BREAK   MEDIUM         5 (SLABS)       1.00          1.50
  63 LINEAR CR      LOW            2 (SLABS)       1.00          1.00
  63 LINEAR CR      MEDIUM         2 (SLABS)       1.00          1.00
  64 DURABIL. CR    LOW           19 (SLABS)       1.90          1.29
  65 JT SEAL DAM    LOW          141 (SLABS)      14.29          2.00
  65 JT SEAL DAM    HIGH         849 (SLABS)      85.71         12.00
  66 SMALL PATCH    MEDIUM         2 (SLABS)       1.00          0.60
  70 SCALING        LOW            7 (SLABS)       1.00          0.50
  71 FAULTING       LOW           17 (SLABS)       1.67          2.06
  71 FAULTING       MEDIUM         5 (SLABS)       1.00          2.00
  73 SHRINKAGE CR   LOW            7 (SLABS)       1.00          0.60
  74 JOINT SPALL    LOW            2 (SLABS)       1.00          0.60
  74 JOINT SPALL    MEDIUM        12 (SLABS)       1.19          1.58
  74 JOINT SPALL    HIGH           5 (SLABS)       1.00          3.00



      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =  12.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  51.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  37.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - CHARLIE PARKING          Slab Length     -     12.50 LF
Branch Number   - A6B                      Slab Width      -     11.00 LF
Section Number  - 1    Family - DEFAULT     Number of Slabs -     1500
===========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  78                             RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    64
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    21
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 8 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  7.5%


       *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  62 CORNER BREAK   MEDIUM         4 (SLABS)       1.00          1.50
  62 CORNER BREAK   HIGH           4 (SLABS)       1.00          3.00
  63 LINEAR CR      LOW           14 (SLABS)       1.00          1.00
  64 DURABIL. CR    LOW           14 (SLABS)       1.00          0.50
  64 DURABIL. CR    MEDIUM         4 (SLABS)       1.00          1.00
  64 DURABIL. CR    HIGH           4 (SLABS)       1.00          2.00
  65 JT SEAL DAM    HIGH        1500 (SLABS)     100.00         12.00
  66 SMALL PATCH    LOW           11 (SLABS)       1.00          0.15
  67 LARGE PATCH    HIGH           7 (SLABS)       1.00          4.00
  70 SCALING        LOW          148 (SLABS)       9.88          3.96
  72 SHAT. SLAB     LOW            4 (SLABS)       1.00          2.50
  73 SHRINKAGE CR   LOW           49 (SLABS)       3.29          0.88
  74 JOINT SPALL    LOW           74 (SLABS)       4.94          2.13
  74 JOINT SPALL    MEDIUM        11 (SLABS)       1.00          1.00
  75 CORNER SPALL   LOW           32 (SLABS)       2.12          0.88
  75 CORNER SPALL   MEDIUM         7 (SLABS)       1.00          0.80
  75 CORNER SPALL   HIGH           4 (SLABS)       1.00          1.20

    *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =  21.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  40.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  39.00 PERCENT DEDUCT VALUES..
```

```
Network ID      - Butts
Branch Name     - DELTA PARKING                 Slab Length    -     12.50 LF
Branch Number   - A7B                           Slab Width     -     12.50 LF
Section Number  - 1    Family - DEFAULT         Number of Slabs -     322
==========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :             Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:               F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  80                              RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    15
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    12
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED = 4.6%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  62 CORNER BREAK   MEDIUM         3 (SLABS)       1.00          0.70
  64 DURABIL. CR    HIGH           2 (SLABS)       1.00          2.00
  65 JT SEAL DAM    HIGH         322 (SLABS)     100.00         12.00
  70 SCALING        LOW           23 (SLABS)       5.88          2.46
  71 FAULTING       LOW            3 (SLABS)       1.00          1.00
  74 JOINT SPALL    LOW           26 (SLABS)       6.72          2.58
  74 JOINT SPALL    MEDIUM         5 (SLABS)       1.26          1.74
  75 CORNER SPALL   LOW           15 (SLABS)       3.78          1.39
  75 CORNER SPALL   MEDIUM         3 (SLABS)       1.00          0.80


      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =   3.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  57.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  40.00 PERCENT DEDUCT VALUES..
```

```
Network ID      - Butts
Branch Name     - DELTA PARKING              Slab Length     -     12.50 LF
Branch Number   - A8B                        Slab Width      -     12.50 LF
Section Number  - 1    Family - DEFAULT      Number of Slabs -     390
==========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  80                             RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    19
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    12
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 10 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  11.2%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  62 CORNER BREAK   LOW             4 (SLABS)       1.20          1.17
  63 LINEAR CR      LOW             3 (SLABS)       1.00          1.00
  63 LINEAR CR      MEDIUM          4 (SLABS)       1.20          2.29
  65 JT SEAL DAM    LOW            40 (SLABS)       8.00          2.00
  65 JT SEAL DAM    HIGH          350 (SLABS)      92.00         12.00
  67 LARGE PATCH    LOW             1 (SLABS)       1.00          0.75
  70 SCALING        LOW             3 (SLABS)       1.00          0.50
  71 FAULTING       LOW            14 (SLABS)       4.00          3.79
  72 SHAT. SLAB     LOW             7 (SLABS)       2.00          4.96
  73 SHRINKAGE CR   LOW             4 (SLABS)       1.20          0.74
  74 JOINT SPALL    LOW            10 (SLABS)       2.80          1.69
  74 JOINT SPALL    MEDIUM          3 (SLABS)       1.00          1.00
  75 CORNER SPALL   LOW             4 (SLABS)       1.20          0.49


      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =  29.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  43.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  28.00 PERCENT DEDUCT VALUES..
```

```
Network ID      - Butts
Branch Name     - DELTA PARKING               Slab Length     -     18.00 LF
Branch Number   - A9B                         Slab Width      -     18.00 LF
Section Number  - 1    Family - DEFAULT       Number of Slabs -     894
===========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :             Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:               F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  64                               RATING = GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    39
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    21
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 19 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  15.6%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  63 LINEAR CR      LOW            4 (SLABS)       1.00          1.00
  63 LINEAR CR      MEDIUM         8 (SLABS)       1.00          1.00
  64 DURABIL. CR    LOW            6 (SLABS)       1.00          0.50
  64 DURABIL. CR    HIGH           2 (SLABS)       1.00          2.00
  65 JT SEAL DAM    MEDIUM       578 (SLABS)      64.68          7.00
  65 JT SEAL DAM    HIGH         316 (SLABS)      35.32         12.00
  71 FAULTING       LOW           18 (SLABS)       1.99          2.33
  71 FAULTING       MEDIUM        20 (SLABS)       2.21          4.68
  71 FAULTING       HIGH           4 (SLABS)       1.00          3.50
  74 JOINT SPALL    LOW          233 (SLABS)      26.05          7.24
  74 JOINT SPALL    MEDIUM       101 (SLABS)      11.26          8.56
  74 JOINT SPALL    HIGH          28 (SLABS)       3.09          9.46
  75 CORNER SPALL   LOW           75 (SLABS)       8.39          3.12
  75 CORNER SPALL   MEDIUM        34 (SLABS)       3.75          2.65
  75 CORNER SPALL   HIGH          30 (SLABS)       3.31          3.75
      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =   3.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  31.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  66.00 PERCENT DEDUCT VALUES.
```

```
 Network ID      - Butts
Branch Name     - B EAST PARKING             Slab Length     -     12.50 LF
Branch Number   - A10B                       Slab Width      -     11.00 LF
Section Number  - 1    Family - DEFAULT       Number of Slabs -     390
===========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :             Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:               F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  84                               RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    20
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    12
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  5.5%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  65 JT SEAL DAM    HIGH         390 (SLABS)     100.00         12.00
  71 FAULTING       LOW            5 (SLABS)       1.25          1.54
  71 FAULTING       MEDIUM         2 (SLABS)       1.00          2.00
  71 FAULTING       HIGH           2 (SLABS)       1.00          3.50
  74 JOINT SPALL    LOW           11 (SLABS)       2.92          1.71
  75 CORNER SPALL   LOW            5 (SLABS)       1.25          0.53

      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  56.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  44.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - B WEST PARKING              Slab Length     -     12.50 LF
Branch Number   - A11B                        Slab Width      -     11.00 LF
Section Number  - 1    Family - DEFAULT        Number of Slabs -     390
===========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  85                             RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    20
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    12
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 5 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  6.7%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE

  62 CORNER BK      LOW             2 (SLABS)       1.00          0.70
  63 LINEAR CR      LOW             2 (SLABS)       1.00          1.00
  65 JT SEAL DAM    MEDIUM         65 (SLABS)      16.67          7.00
  65 JT SEAL DAM    HIGH          325 (SLABS)      83.33         12.00
  72 SHAT. SLAB     MEDIUM          2 (SLABS)       1.00          5.00
  73 SHRINKAGE CR   LOW             2 (SLABS)       1.00          0.60
  74 JOINT SPALL    LOW             7 (SLABS)       1.67          1.36
  74 JOINT SPALL    MEDIUM          3 (SLABS)       1.00          1.00
  75 CORNER SPALL   LOW             3 (SLABS)       1.00          0.30

      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =  23.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  66.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  11.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - COMPASS ROSE                 Slab Length     -     12.50 LF
Branch Number   - A12B                         Slab Width      -     12.50 LF
Section Number  - 1    Family - DEFAULT         Number of Slabs -     64
==========================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:              F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  84                               RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    4
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    4
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 4 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  10.1%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY       QUANTITY      DENSITY %    DEDUCT VALUE


  65 JT SEAL DAM    LOW           19 (SLABS)      25.00          2.00
  65 JT SEAL DAM    HIGH          58 (SLABS)      75.00         12.00
  71 FAULTING       LOW            1 (SLABS)       1.56          1.95
  74 JOINT SPALL    LOW            1 (SLABS)       1.56          1.30
  74 JOINT SPALL    HIGH           1 (SLABS)       1.56          5.09
  75 CORNER SPALL   LOW            1 (SLABS)       1.56          0.69
  75 CORNER SPALL   MEDIUM         1 (SLABS)       1.56          1.05

      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =   0.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =  58.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  42.00 PERCENT DEDUCT VALUES.
```

```
Network ID      - Butts
Branch Name     - ALPHA RAMP                     Slab Length     -     15.00 LF
Branch Number   - A13B                           Slab Width      -     15.00 LF
Section Number  - 1    Family - DEFAULT          Number of Slabs -     2870
============================================================================

  ----------------------------------------------------------------------
  Inspection Date: 5/18/2002
  Riding Quality :            Safety:       Drainage Cond.:
  Shoulder Cond. :      Overall Cond.:               F.O.D.:
  ----------------------------------------------------------------------

  PCI OF SECTION =  81                             RATING = VERY GOOD

  TOTAL NUMBER OF SAMPLE UNITS =    136
  NUMBER OF RANDOM SAMPLE UNITS SURVEYED     =    30
  NUMBER OF ADDITIONAL SAMPLE UNITS SURVEYED =     0
  RECOMMENDED MINIMUM OF 17 RANDOM SAMPLE UNITS TO BE SURVEYED.
  STANDARD DEVIATION OF PCI BETWEEN RANDOM UNITS SURVEYED =  11.1%


         *** EXTRAPOLATED DISTRESS QUANTITIES FOR SECTION ***

  DISTRESS-TYPE    SEVERITY      QUANTITY      DENSITY %    DEDUCT VALUE

  62 CORNER BK      LOW           14 (SLABS)       1.00          0.70
  62 CORNER BK      MEDIUM         5 (SLABS)       1.00          1.50
  63 LINEAR CR      LOW           19 (SLABS)       1.00          1.00
  64 DURABIL. CR    LOW           10 (SLABS)       1.00          0.50
  66 SMALL PATCH    LOW           24 (SLABS)       1.00          0.15
  70 SCALING        LOW            5 (SLABS)       1.00          0.50
  71 FAULTING       LOW          148 (SLABS)       5.17          4.68
  71 FAULTING       MEDIUM        14 (SLABS)       1.00          2.00
  73 SHRINKAGE CR   LOW          139 (SLABS)       4.83          1.05
  74 JOINT SPALL    LOW          483 (SLABS)      16.83          5.24
  74 JOINT SPALL    MEDIUM       139 (SLABS)       4.83          4.27
  74 JOINT SPALL    HIGH           5 (SLABS)       1.00          3.00
  75 CORNER SPALL   LOW          411 (SLABS)      14.33          5.26
  75 CORNER SPALL   MEDIUM        38 (SLABS)       1.33          0.93
  75 CORNER SPALL   HIGH          10 (SLABS)       1.00          1.20
      *** PERCENT OF DEDUCT VALUES BASED ON DISTRESS MECHANISM ***

  LOAD                 RELATED DISTRESSES =  10.00 PERCENT DEDUCT VALUES.
  CLIMATE/DURABILITY   RELATED DISTRESSES =   2.00 PERCENT DEDUCT VALUES.
  OTHER                RELATED DISTRESSES =  88.00 PERCENT DEDUCT VALUES.
```

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13. SUPPLEMENTARY NOTES

14. ABSTRACT

An airfield pavement evaluation was performed in May 2002 at Butts Army Airfield, Fort Carson, Colorado, to develop information pertaining to the structural adequacy of the airfield pavements for continued use under its current mission and the upgrading of the pavements for mission changes. The pavement surface condition was evaluated using the Pavement Condition Index (PCI) survey procedure, and a nondestructive evaluation procedure was used to determine the load-carrying capability of the pavements and overlay requirements for continued use of the pavements under current missions. Results of the evaluation are presented including: (a) a tabulation of the existing pavement features, (b) the results of the nondestructive tests performed using a heavy weight deflectometer, (c) the PCI and rating of the surface of each pavement feature, (d) a structural evaluation and overlay requirements for 6,000 passes of the C-130 aircraft on the fixed-wing pavements and 50,000 passes of the CH-47 aircraft on the rotary-wing pavements, (e) the pavement classification number for each pavement facility, and (f) maintenance and repair recommendations based on the structural evaluation and condition survey.

15. SUBJECT TERMS

Aircraft classification number	Nondestructive testing
Allowable gross aircraft load	Pavement classification number
Butts Army Airfield	Pavement condition index

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
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